TO STUDY THE COLISTIN SUSCEPTIBILITY OF GRAM NEGATIVE ISOLATES FROM BLOOD SAMPLES

A THESIS SUBMITTED TO

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT (PUNJAB)

IN THE PARTIAL FULFILLMENT

FOR THE AWARD OF DEGREE OF

DOCTOR OF MEDICINE

IN

MICROBIOLOGY

MAY 2022

Submitted By

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Dedicated

To my husband

Aman Inderjeet Singh

my brother

Dr. Arshdeep Singh

&

My family

LIST OF ABBREVIATIONS

AK	Amikacin
AMC	Amoxiclav
AST	Antimicrobial susceptibility test
ATCC	American Type Culture Collection
BSI	Blood stream infections
BMD	Broth microdilution
C	Chloramphenicol
COL	Colistin
CLSI	Clinical and Laboratory Standards Institute
CR	Carbapenem resistant
CR-GNB	Carbapenem resistant Gram negative bacteria
CRE	Carbapenem resistant Enterobacteriaceae
CRKP	Carbapenem resistant *Klebsiella pneumoniae*
CRAB	Carbapenem resistant *Acinetobacter baumannii*
CRPA	Carbapenem resistant *Pseudomonas aeruginosa*
CA-MHB	cation-adjusted Muller-Hinton broth
CBDE	colistin broth disk elution
CMS	Colistimethate Sodium
CFM	Cefuroxime
CTR	Ceftriaxone
CAZ	Ceftazidime
CPM	Cefepime
COT	Cotrimoxazole
CIP	Ciprofloxacin
CFSB	Cefaperazone sulbactam
DIC	Disseminated intravascular coagulopathies
EUCAST	European Committee on Antimicrobial Susceptibility Testing
ECDC	European Centre for Disease Control
EDTA	Ethylenediaminetetraacetic acid
FQ	Fluoroquinolones
GNB	Gram Negative bacilli
GEN	Gentamicin
ICU	Intensive care unit
IMI	Imipenem
KPC	*Klebsiella pneumonia* carbapenemase
LPS	Lipopolysaccharides
LEVO	Levofloxacin
MHT	Modified Hodge test
MEM-ERT	Modified Hodge test with ertapenem
MEM-MHT	Modified Hodge test with meropenem
MALDI-TOF MS	matrix-assisted laser desorption ionisation time-of-flight

	mass spectrometry
MIC	Minimum Inhibitory Concentration
MBL	Metallo-β-lactamases
MERO	Meropenem
MDR	Multidrug-resistant
MDROs	Multidrug-resistant organisms
NCTC	National collection of type cultures
NDM	New Delhi metallo-beta-lactamase
OXA	Oxacillinases
OM	Outer membrane
OF	Ofloxacin
PK	Pharmacokinetics
PBP	Penicillin binding proteins
PCR	Polymerase chain reaction
PDR	Pan drug resistant
PT	Piperacillin tazobactam
RRT	Renal replacement therapy
ST	Susceptibility testing
VAP	Ventilator associated pneumonia
VAT	ventilator-associated tracheobronchitis
VIM	Verona integron-encoded metallo-β-lactamase
WHO	World Health Organization
WGS	Whole Genome Sequencing
XDR	Extensively drug-resistant

ABSTRACT

INTRODUCTION

Bloodstream infection due to Gram negative bacteria (GNB) is a serious problem in hospitals. They have become increasingly resistant to currently available antimicrobial agents thus leading to multi-drug resistant isolates. Carbapenems are used for treatment of infections caused by these multi drug resistant organisms. However, carbapenem resistance is not uncommon. Colistin is the last resort for these carbapenem resistant (CR) GNB.

AIMS & OBJECTIVES

To identify and determine the antibiotic susceptibility pattern of Gram negative isolates from the blood samples.
To determine the colistin MIC of carbapenem resistant Gram negative isolates by Broth microdilution dilution technique.

MATERIALS AND METHODS

The present study was a prospective study conducted in the Department of Microbiology, DMCH, Ludhiana over a period of one year from 1st January 2020 to 31st December 2020. The Gram negative bacteria were isolated from the blood samples of the admitted patients, further identification and antimicrobial susceptibility was done by VITEK-2 system. Broth microdilution method was used to determine the MIC of colistin for the carbapenem resistant Gram negative isolates.

RESULTS

Gram negative bacteria (GNB) were the most common (75.8%) cause of BSI which was majorly seen in male patients (2:1). *E.coli* (31.8%) was the most common organism isolated. These GNB isolates were highly resistant to cephalosporins and ciprofloxacin (70%). Carbapenem resistance was seen in 48.5% of the isolates. *Acinetobacter* (65.9%) and *Klebsiella sp.* (62.9%) showed higher resistance to carbapenems. These isolates showed significant association with resistance to other classes of antibiotics and ICU stay. Colistin resistance was seen in the 2.9% of the carbapenem resistant isolates. Majority of the patients with colistin resistant infections were from ICUs, had indwelling devices, comorbidities and prolonged hospital stay.

CONCLUSION

Predominantly Gram negative bacteria were the most common cause of BSI, exhibiting resistance to clinically important antimicrobial agents. More percentage of carbapenem resistance was seen in patients admitted in ICUs. A significant association was seen between carbapenem resistant isolates and resistance to other classes of antibiotics. Mortality was observed more in patients harbouring carbapenem resistant isolates. BMD is a reliable method for determination of MIC of colistin. . VITEK-2 system failed to detect the colistin resistance among the isolates. Mortality rate among the patients with colistin resistant infections was comparatively high. Therefore, colistin should be preserved and used judiciously after antibiotic susceptibility testing.

ACKNOWLEDGEMENT

I am grateful to GOD Almighty for his grace and blessings which enabled me to tide over the thick and thin during the course of my thesis. Wherever I faltered along the way, he was always there to light me up in his lap like an endearing parent to tide over obstacles. Endeavour, no matter how spirited and consistent does little to steer one, unless coupled with discrete guidance.

With great pleasure I take this opportunity to thank all those who helped me in the successful completion of my work. I gratefully acknowledge the patience, keen personal interest and guidance rendered by my esteemed & revered teacher, mentor and Chief Supervisor **Dr. Jyoti Chaudhary**, Associate Professor, Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana. Her innovative ideas and accommodative attitude helped me at various stages during the culmination of this project. I consider myself privileged to be her student. I deem myself blessed of being showered with parental love, guidance and inspiration. This project could never have been brought to a realization without her dedicated involvement, patient hearing and enthusiastic help at each and every step of this journey. Her thorough knowledge of the subject and pursuit for perfection has been a constant inspiration. I wish to express my deep & heartful gratitude for my esteemed teacher & co-supervisor **Dr. Veenu Gupta**, Professor & Head, Department of Microbiology, DMCH, Ludhiana. Her constant kindness, courtesy, meticulous care, encouragement, untiring help and constructive suggestions helped me throughout my study. It was her contribution and dedicated involvement which gave me the courage to materialize this work and winnow the ocean of data and wield the facts.

I am also indebted to **Dr Sandeep Puri**, Principal, DMCH, Ludhiana for providing all the necessary facilities in the department.

I have great pleasure in expressing my sincere thanks to **Dr Rama Gupta**, Professor Department of Microbiology DMCH and **Dr Meenal Gupta**, Assistant Professor Department of Microbiology DMCH, Ludhiana for guiding and encouraging me throughout the period of study.

Most importantly, none of this could have happened without my family. Parents are always a perpetual source of inspiration & encouragement. No words can express what their constant undemanding love, sacrifice, dedication & prayers have done to achieve me whatever I am today. I would just like to take this opportunity to thank my parents **Mr Surjit Singh** and **Mrs Rajwant Kaur** and The head of our family, my father-in-law, **Mr S.R. Lakha** and my mother-in-law, **Late Mrs Nisha Lakha** for their humble support and constant encouragement, without them it could not have been possible. The lessons and values they have taught me have helped me to become a stronger person. I owe a special reverence because contrary to all odds they had given me the best possible education and without their guidance, encouragement and blessings, I would never have been what I am today. I would also like to give special thanks to my beloved husband **Mr Aman Inderjeet Singh Lakha** for his continuous support and understanding. His prayers for me has what sustained me so far. His ceaseless and unfailing inspiration helped me to make full efforts to give this project a shape. His selfless love and caring attitude will always be an endless support to me.

Sincere thanks to my brother **Dr Arshdeep Singh,** my sister-in-law **Simranjeet Kaur** for their humble support and encouragement.

I would like to thank my senior **Dr Tanureet** for her constant help and suggestions throughout the study.

I am thankful to my colleagues and friends **Dr. Bavleen Miglani** and **Dr. Harmandeep Kaur Sandhar** for constantly guiding through my thick and thin in every aspect and understanding me without even saying anything and offering solution to every problem I faced.

I would also like to thank the little ones **Dr. Monica and Dr. Divjot** for their constant support & help.

Thank you **Mr Shuklaji** for breakfasts and tea-breaks.

I'd also want to thank the technicians at department's laboratory for their assistance in providing me with the resources I needed.

Last but not the least I would like to thank **Mrs Namita Bansal** and **Miss Neha Bhatt** and all the R&D staff for their skillful analysis & typing of the manuscript.

I acknowledge the help of all those invisible hands who are responsible for the successful outcome of this dissertation

Dr. Samandeep Kaur Lakha

TABLE OF CONTENTS

S. NO.	TOPIC	PAGES
I	INTRODUCTION	1-5
II	AIMS AND OBJECTIVES	6
III	REVIEW OF LITERATURE	7-32
IV	MATERIALS AND METHODS	33-39
V	OBSERVATIONS AND RESULTS	40-72
VI	DISCUSSION	73-80
VII	SUMMARY AND CONCLUSIONS	81-85
VIII	BIBLIOGRAPHY	86-103
	APPENDICES – I - PROFORMA - MASTER CHART	
	APPENDICES – II - APPROVAL LETTER OF THESIS PLAN - THESIS PLAN	

LIST OF TABLES

Table No.	Title	Page No.
1.	Classification of β-lactamases	12
2.	Main events related to colistin	19
3.	Spectrum of activity of colistin among various Gram negative bacteria	22
4.	Mechanisms of colistin resistance in members of Enterobacteriaceae family	25-26
5.	Volume of components added per well	39
6.	Interpretation of results	39
7.	Time to positivity of Gram negative bacterial isolates from blood samples (n=546)	43
8.	Distribution of Gram negative bacterial isolates from blood samples (n=546)	44
9.	Antibiotic susceptibility pattern of Gram negative isolates (n=546)	45
10.	Antibiotic susceptibility pattern of the predominant Gram negative bacterial isolates (n=546)	47
11.	Distribution of patients with BSI due to carbapenem resistant isolates in various ICUs and wards (n=246)	53
12.	Distribution of patients with BSI due to predominant carbapenem resistant isolates in various ICUs and wards (n=246)	54
13.	Comparison of antibiotic susceptibility profile of common carbapenem sensitive (n=261) and resistant (n=246) isolates	59-60
14.	Comparison of clinical characteristics of patients with Carbapenem sensitive and resistant isolates	61-62
15.	Distribution of patients with colistin resistant isolates according to length of hospital stay (n=7)	63
16.	Colistin susceptibility profile of carbapenem resistant isolates by Broth microdilution method (n=245)	65

17.	Distribution of carbapenem resistant Gram negative isolates with colistin MIC (n=245)	67
18.	MIC of various other antibiotics for the colistin resistant isolates (n=7)	69
19.	Comparison of antibiotic susceptibility profile of colistin intermediate and resistant isolates (n=245)	70
20.	Comparitive analysis between imipenem and meropenem resistant isolates with colistin susceptibility (n=245)	71
21.	Comparison of clinical characteristics of patients with colistin intermediate and resistant isolates (n=245)	72

LIST OF FIGURES

Fig. No.	Title	Page No.
1.	Gender wise distribution of the patients with BSI (n=546)	40
2.	Age wise distribution of the patients with BSI (n=546)	41
3.	Area wise Distribution of patients with BSI (n=546)	41
4.	Comorbidities in the patients with BSI (n=546)	42
5.	Graphical representation of time to positivity of Gram negative bacterial isolates from blood samples (n=546)	43
6.	Graphical representation of antibiotic susceptibility pattern of Gram negative bacterial isolates(n=546)	46
7.	Graphical representation of antibiotic susceptibility pattern of the predominant Gram negative bacterial isolates (n=546)	48
8.	Characterization of Gram Negative Isolates (n=546)	49
9.	Characterization of common Gram negative isolates (n=546)	50
10.	Gender wise distributionof patients with BSI due to carbapenem resistant isolates(n=246)	51
11.	Age wise distribution of patients with BSI due to carbapenem resistant isolates (n=246)	51
12.	Area wise distribution of patients with BSI due to carbapenem resistant Gram negative isolates (n=246)	52
13.	Percentage of various carbapenem resistant isolates (n=246)	55
14.	Antibiotic susceptibility profile of common carbapenem resistant isolates (n=246)	56
15.	Antibiotic susceptibility profile of common carbapenem sensitive isolates(n=261)	57
16.	Outcome of patients with BSI due to carbapenem resistant and carbapenem sensitive Gram negative bacteria (n=507)	61
17.	Area-wise distribution of patients with colistin resistant isolates (n=7)	63

18.	Risk factors in patients with colistin resistant isolates (n=7)	64
19.	Comorbidities in patients with colistin resistant isolates (n=4)	65
20.	Graphical representation of colistin susceptibility profile of carbapenem resistant isolates (n=245)	66
21.	Comparison of colistin MIC by BMD method and VITEK-2 system	68
22.	Outcome of the patients with colistin resistant isolates	71

LIST OF PICTURES

Picture No	Title
1	BLOOD CULTURE BOTTLES
2	BACTEC 9240-BLOOD CULTURE AUTOMATED SYSTEM
3	BACT/ALERT-BLOOD CULTURE AUTOMATED SYSTEM
4	VITEK-2 system
5	Markings on 96-well Microtiter plate
6	BMD Test

INTRODUCTION

The emergence of resistance to multiple antimicrobial agents in Gram negative bacteria is increasing worldwide and is a significant threat to public health as well as hospitalized patients. World Health Organization (WHO) has declared antibiotic resistance as one of the top 10 threats to global public health. Lack of judicious use of broad spectrum antimicrobials contributes to this threat. The evolution of drug resistance in many human pathogens and a gradual decline in antibiotic discovery and development has led to the current antimicrobial resistance crisis. Therefore, continuous surveillance of antimicrobial resistance and antimicrobial stewardship is necessary to prevent development of resistance to these precious antibiotics.

Klebsiella spp., E.coli, Acinetobacter baumannii, Pseudomonas aeruginosa are the predominant Gram negative pathogens associated with nosocomial and community infections. They cause infections at various body sites including the bloodstream, respiratory tract, urinary tract, surgical sites, and wounds. These infections occur more frequently in critically ill patients, particularly in immunocompromised and hospitalized patients, especially in the intensive care units (ICUs).[1] These bacteria survive for a long period in the hospital environment, hence the opportunities for cross infection between patients are enhanced and the hospital acquired infections are more resistant to the antibiotics.

Resistance to aminoglycosides, fluoroquinolones,ureido-penicillins and third-generationcephalosporins in these pathogens is being increasingly reported worldwide. Multidrug and extensively drug resistant (MDR/XDR) Gram negative infections have been increasing worldwide.[2] They have been associated with longer hospitalization, higher mortality and greater cost of care.

Studies have shown that resistance to antibiotics is directly linked to their usage.[3, 4] Antibiotic usage was reported highest in 2018 across the Central Europe, Eastern Europe, and Central Asia. Dramatic increase in antibiotic usage was noted in India as well. (48% to 67%).[5]

Hence, to survive the effects of antibiotics, bacteria are constantly finding new defense strategies, called “resistance mechanisms.”

Antimicrobial resistance in GNB occurs either due to the expression of antibiotic inactivating enzymes and non-enzymatic paths which may result from increasing the intrinsic resistance due to mutations in chromosomal genes (such as increasing the expression of antibiotic-inactivating enzymes, efflux pumps, permeability or target modifications) or acquired by transfer of mobile genetic elements(plasmid) carrying resistance genes encoding β-lactamases, aminoglycosides modifying enzymes, or non-enzymatic mechanisms like Qnr (plasmid-borne quinolone resistance gene) for fluoroquinolone (FQ) resistance in Enterobacteriaceae.[6]

Carbapenems are frequently used for the treatment of infections due to the MDR-GNB. The carbapenems are beta-lactam antimicrobial agents with broad spectrum of activity. They act by inhibiting bacterial cell wall synthesis by binding to and inactivating penicillin-binding proteins (PBPs).[7] But with emergence of super bugs, several recent studies have shown that the infections due to carbapenem resistant organisms are not uncommon now. WHO has listed CR Enterobacteriaceae as one of the top priority pathogens responsible for widespread concern.[7] Carbapenem-resistant GNB including *Acinetobacter baumannii, Pseudomonas aeruginosa* and Enterobacteriaceaeare critical pathogens, for which limited treatment options are available. These microorganisms evolved by various resistance mechanisms against carbapenems i.e. through acquisition of genes coding for enzymes leading to breakdown of carbapenems, overexpression of a beta-lactamase enzyme with weak carbapenemase activity, modifications in permeability of porins, overexpression of efflux pumps and presence of mutated or reduced expression of outer membrane proteins, preventing the uptake of antimicrobial drug.[8]

The most common mechanism of resistance is through production of carbapenemases. Carbapenemases are beta-lactamases with versatile hydrolytic capacities. They have the ability to hydrolyze penicillins,

cephalosporins, monobactams, and carbapenems.[9] Various classes of carbapenemases include Serine carbapenemases(KPC-*Klebsiella pneumoniae* carbapenemases), metallo-β-lactamases (MBL), cephalosporinases and oxacillinases.[10] In the United States, KPC serine carbapenemases are more prevalent, while in India, NDM-1 has been reported to be the most extensively observed carbapenemase among Enterobacteriales.[11,12] Carbapenem resistance rates for *Klebsiella pneumonia* are above 25% while 20 to 40% is for *P. aeruginosa.*[6] There has been an alarming increase in reports of CR *Acinetobacter spp*. over the last decade. Highest levels(80%) were reported in some countries in the south and southeastern parts of Europe and in the Baltic States.[13] About 40 to 70% of intensive care unit (ICU) acquired infections are due to carbapenem-resistant *A. baumannii*(CRAB).[6]

Due to the alarming rise in carbapenem resistance, management of these infections becomes a great challenge for clinicians due to the limited choice in antibiotics. Polymyxins, high dose tigecycline, aminoglycosides, prolonged infusion of high dose carbapenem and double carbapenem therapy are being considered as potential therapeutic option.[7] The polymyxins were first recognized to have broad-spectrum activity against GNB in the 1940s and were used therapeutically for two decades (1960-1980),[14] but were discontinued due to side effects like nephrotoxicity & neurotoxicity. With rise in rates of resistance to carbapenems, the usage of colistin has increased over the years as it has shown excellent activity against multi drug resistant organisms (MDRO). So, it has been re-emerged as only therapeutic option in combination with other antibiotics for these organisms.[15] Two groups of polymyxins are currently being used in clinical practice; this includes polymyxin B and polymyxin E(colistin). Colistin has significant activity against GNB as it targets lipopolysaccharides(LPS) in the outer membrane. These are positively charged peptide molecules which act by binding to the negatively charged LPS, displacing the magnesium ions leading to loss of cell wall integrity, thereby cell death.[16]

In vitro susceptibility testing of colistin is challenging and is influenced by multicomponent composition of colistin; cationic property, heteroresistance to colistin. In vitro Colistimethate Sodium (CMS) is an inactive prodrug, hydrolysis to active colistin during incubation results in three to eight folds higher Minimum Inhibitory Concentration (MIC) than colistin sulfate. Hence, susceptibility testing (ST) should be performed only with colistin sulphate.[17] Several studies in the literature have reported considerable discrepancies of the MICs produced by gradient tests (E-test and MIC test strips), causing considerable variations in the colistin antimicrobial susceptibility testing (AST) results.[18,19]

The therapeutic challenges include high nephrotoxicity and neurotoxicity, optimizing dosage, promotion of resistance during sub-optimal dosage, lack of uniformity in dosing units with respect to critically ill individuals and narrow therapeutic window.[20]

An accurate method for AST of colistin is crucial in an era of increasing numbers of MDR-GNB.

Based on the poor performance of these commonly used methods, CLSI (Clinical laboratory and standards institute) do not recommend using disk diffusion or gradient diffusion for colistin susceptibility testing and instead recommend the use of Broth microdilution (BMD), colistin broth disk elution and colistin agar dilution test.[16]

Even with the availability of newly approved antimicrobial agents for CR-GNB, there is continued use of polymyxins because they are active against only a subset of CR-GNB and because the high costs of the new agents may limit their use in the areas of the world where the need is greatest.[21]

With its increased usage, colistin resistance among CR-GNB has been increasing now. It occurs either due to changes in the LPS by replacement of negatively charged phosphate with positively charged L-Ara4N and PetN molecules, thereby preventing the interaction of colistin with LPS. Development of colistin resistance can occur by plasmid mediated resistance, efflux pumps and heteroresistance

(results in the amplification of the resistant subpopulations in the presence of polymyxin alone).[16]

There are sporadic reports of emergence of colistin resistance from different parts of the world.[22] Although resistance to polymyxins reported is generally<10%, it is higher in the Mediterranean and South-East Asia(Korea and Singapore).[23] Indian studies have reported varied prevalence of colistin resistance ranging from 1.1% to 38.3%.[24-26] Colistin resistance in *Klebsiella pneumoniae* is a serious issue reported throughout the world.[27] There has been a steady increase in incidence of colistin resistant *Klebsiella pneumoniae* in the clinical setting in several countries of Europe, America and Asia. In two multicenter analyses of carbapenem resistant *Klebsiella pneumoniae*(CRKP) from U.S reported 13% to 16% of colistin resistant isolates. A multicenter study from Italy demonstrated that 43% of colistin resistance in (CRKP).[22]

Colistin resistance has also emerged among *A.baumannii* isolates and, to a lesser degree, among *P.aeruginosa* isolates.[28,29]

Under reporting of colistin resistant bacteria is becoming a clinical concern. It is critical that clinical microbiology laboratories be able to identify the accurate colistin susceptibility, and it should be used according to the ST results, so that patients do not receive this nephrotoxic therapy when it is unlikely to be effective. Also it will help to prevent the development of resistance among GNB to this valuable antibiotic. Hence this study was planned to determine antibiotic susceptibility of GNB isolated from the blood samples by VITEK-2 system and further determination of colistin MIC of CR Gram negative isolates by BMD technique.

AIMS AND OBJECTIVES

- To identify and determine the antibiotic susceptibility pattern of Gram negative isolates from the blood samples.
- To determine the colistin MIC of carbapenem resistant Gram negative isolates by Broth microdilution technique.

REVIEW OF LITERATURE

INTRODUCTION

Blood stream infections (BSI) are the most common cause of morbidity and mortality in tertiary care hospitals. Enterobacteriaceae and the non-fermenters (*Pseudomonas spp.* and *Acinetobacter spp.*) are the most common clinical isolates obtained from blood samples. Infections due to GNB are most commonly encountered in patients admitted in ICUs. Microbial invasion of bloodstream can have serious complications such as shock, multiple organ failure, and DIC (disseminated intravascular coagulopathies). Therefore, timely detection of causative agents is one of the most important goals so that appropriate antibiotics can be given in a timely manner.Blood culture is a vital tool and remains the gold standard for bacteremia detection.

Worldwide, the range of 5–7% of ICU admissions are reported to have developed a BSI. This corresponds to a mean of 6–10 episodes per 1000 patient-days.[30]

According to geographical distribution in Western Europe, Northern America and Asia, the major prevalence is of *E.coli* BSIs, while in Eastern Europe and Southern America the leader is *Klebsiella pneumoniae*.

In the case of critically ill patients, due to their high predisposition to BSIs, in the first month of hospitalization in ICUs, a 7% incidence of BSIs has been reported.[31]

Studies have reported GNB as the most common cause of BSIs.[32,33]

In a retrospective descriptive record-based study of one year at BJ Government Medical College, Pune, a total of 5588 blood samples were received, out of which 600 bacterial isolates of GNB were obtained. Enterobacteriaceae and non-fermenters contributed to 38%, and 31% respectively. The predominant organisms were *Acinetobacterspp.* (n = 88) and *Klebsiella spp*. (n = 84). Among Gram-negative pathogens, Enterobacteriaceaeas a group accounted for maximum sepsis cases 35% of total sepsis and 55.52% (231/416) of all Gram-negative sepsis.[34]

A study by Ashish bajaj *et al.* reported 316 (65.8%) and Mehta M. *et al* reported 80.96% BSI due GNB.[32, 35]

In another study at a tertiary care haematology institution, 393 febrile neutropenic episodes occurring in 123 patients over a 1-year period were analysed for microbiological profile, sensitivity, resistance patterns and clinical outcomes. GNB-BSI (46.9%) was more prevalent as compared to gram-positive infections (41.9%). Increased resistance to carbapenems, beta-lactam beta-lactamase inhibitor combinations, aminoglycosides, fluoroquinolones and cephalosporins were observed.[36]

ANTIBIOTIC RESISTANCE IN GRAM NEGATIVE BACILLI

Infections due to antibiotic resistant GNB are increasing day by day.

Various studies have shown that resistance to antibiotics is directly linked to antibiotic usage.[3, 4, 37, 38]

In 2018, antibiotic usage was highest across the Central Europe, Eastern Europe, and Central Asia super-region, with national estimates highest in Ukraine (80%), Kazakhstan (80%), Bosnia and Herzegovina (79%), and Belarus (79%).

Dramatic increases in antibiotic usage were noted in Sudan (from 49% to 73%), India (from 48% to 67%), and parts of Southeast Asia (Vietnam, 59% to 74%); and Cambodia (63% to 77%).

South Asia (India, Pakistan, Nepal, Bangladesh, and Bhutan), with a population of 1·8 billion, consumed over a quarter (25·2%) of all antibiotics in 2018, whereas China alone (1·4 billion population) consumed 10 %.

The lowest levels of antibiotic usage were estimated for sub-Saharan Africa, with Mauritania having the lowest national usage of any country (23%).[5]

Gram negative organisms have a wide range of mechanisms to prevent the action of many antimicrobials used in clinical medicine. These include efflux pumps, alteration of the drug binding site and membrane permeability, degradation enzymes and the conformational change of the drug leading in its inactivation.[39]

GNB can acquire resistance to different classes of antimicrobials and can be classified as multidrug-resistant (MDR; resistant to ≥1 antimicrobial agent in ≥3 classes), extensively drug-resistant (XDR; resistant to ≥1 antimicrobial agent in all but ≤2 antimicrobial categories) and pandrug-resistant (PDR; resistant to all antimicrobials).[40]

Antibiotic resistant infections, particularly those caused by these MDROs presents a severe threat to global public health. Patients who are infected with MDROs often have an increased risk of prolonged illness and mortality. There are a few studies which show the rising trends of antimicrobial resistance.

A retrospective study was conducted in 10 hospitals regarding the relationship between MDR pathogens and mortality in India. AST results for *Enterococcus* spp., *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* spp. were analyzed for their association with patient mortality outcomes. The overall mortality rate of patients was 13.1%, and there was a significant relationship between MDR and mortality.[41]

In another study by Basak *et al.,* the antibiotic susceptibility profile of 1060 bacterial strains was studied. Out of 1060 bacterial strains, 393 (37.1%) were MDR, 146 (13.8%) strains were XDR, and no PDR was isolated. Amongst 250 GNB-MDR strains, the most common MDR strain was *E.coli* 79/250 (31.6%), followed by *Klebsiella pneumoniae* 75/250 (30%). Similarly, out of 90 GNB-XDR strains, *Pseudomonas aeruginosa* 29/90 (32.2%) was the most common XDR strain, followed by *Klebsiella pneumoniae* 25/90 (27.8%).[42]

Aly and Balkhy reported that the most prevalent MDRO in their study was *E. coli* followed by *Klebsiella pneumonia.*[43]

In studies by Porwal R *et al.*, Swati *et al.* and Ashish Bajaj *et al.,* the antimicrobial susceptibility pattern, among the Enterobacteriaceae family, revealed a high level of resistance to common antimicrobials such as cephalosporins (70-80%) and fluoroquinolones (70%).[35, 44,45] This could be attributed to the irrational use of these antibiotics in hospital-care settings.

As per European Centre for Disease Control (ECDC)'s latest data, Italy tops the chart with the highest frequency of MDR invasive organisms amongst European countries.[46] The burden of multidrug resistance in GNB now represents a daily issue for the management of ICU patients. Carbapenems stands as the first-line choice in this situation.

CARBAPENEMS

Carbapenems are potent members of the β-lactam family of antimicrobials which are structurally related to the penicillins. Mode of action of carbapenems is initiated first by penetrating the bacterial cell wall and binding to enzymes known as PBPs.[47]

Carbapenem are very effective antimicrobials which are administered intravenously with little or no allergic cross reactions in hospitals.[48]

CARBAPENEM RESISTANCE

However,carbapenem resistance in Gram-negative organisms is increasingly encountered in healthcare-associated infections in India.

Carbapenem resistance is a major and an on-going public health problem globally.

It occurs mainly among GNBs such as *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Acinetobacter* baumannii. It may be intrinsic or mediated by transferable carbapenemase-encoding genes. Acquired mechanisms of resistance include enzymatic inactivation, target site mutation and efflux pumps. The most common mechanisms of resistance to carbapenems in GNB is through production of carbapenemases.[49] Carbapenemases are beta-lactamases with versatile hydrolytic capacities. They have the ability to hydrolyze penicillins, cephalosporins, monobactams, and carbapenems.[8]

Classification of β-lactamases can be defined according to two properties, functional and molecular.

Classification based on amino acid homology has resulted in four major classes-

(Molecular/Ambler classification)

Class A-Serine carbapenemases (KPC; non-metallo-carbapenemase/imipenemhydrolysing beta-lactamase and *Serratiamarcescens* enzyme);

Class B - including the MBL,Verona integron-encoded MBL[VIM]; active on imipenem [IMP]; and NewDelhi MBL [NDM];

Class C - cephalosporinases (Amp C)(*P. aeruginosa* can acquire resistance through a gene mutation (ampR) which leads to overexpression of AmpC β-lactamase).[50]

Class D- β-lactamases (OXA-48, OXA-181, etc.)[9]

Molecular classes A, C, and D include the β-lactamases with serine at their active site, whereas molecular class B β-lactamases are all metalloenzymes with an activesite zinc.[9]

Functional classification schemes that included carbapenemases were first proposed by Bush in 1988.[10]

Three major groups of enzymes are defined by their substrate and inhibitor profiles:

GROUP 1-cephalosporinases that are not well inhibited by clavulanic acid;

GROUP 2-penicillinases, cephalosporinases, and broad-spectrum b-lactamases that are generally inhibited by active site-directed b-lactamase inhibitors; and

GROUP 3-metallo-b-lactamases that hydrolyze penicillins, cephalosporins, andcarbapenems and that are poorly inhibited by almost all b-lactam-containing molecules.

Table 1: Classification of β-lactamases

AMBLER CLASS	BUSH-JACOBY MEDEIROS GROUP	ACTIVE SITE	ENZYME TYPE	HOST ORGANISMS	SUBSTRATES
A	**2b, 2be,2br,2c,2e, 2f**	serine	Broad spectrum b-lactamases(TEM,SHV) ESBL(TEM,SHV,CTX-M) Carbapenemases(VIM,IMP)	Enterobacteriaceae and nonfermenters	Ampicillin, cephalothin, Penicillins, 3rd –generation cephalosporins All b-lactams
B	**3**	Zinc-binding thiol group	Carbapenemases(VIM, IMP)	Enterobacteriaceae and nonfermenters	All b- lactams
C	**1**	Serine	AmpCCephamycinases AmpCCephamycinases(CMY,DHA, MOX FOX, ACC)	*Enterbacter species* *Citrobacter species* Enterobacteriaceae	Cephamycins, 3rd-generation cephalosporins
D	**2d**	serine	Broad spectrum b-lactamases(OXA) ESBL(OXA) Carbapenemases(OXA)	Enterobacteriaceae Enterobacteriaceaeand nonfermenters	Oxacillin, Ampicillin, cephalothin, Penicillins, 3rd –generation cephalosporins, all b-lactams

There are five major carbapenemases which include:

I. Klebsiella pneumonia carbapenemase(KPC) class A serine based β-lactamases
II. Class B, New Delhi Metallo-β-lactamases (NDM)
III. Verona integrin encoded Metallo-β-lactamase (VIM)
IV. Class D, OXA or OXA-48-like carbapenemases and
V. Active on imipenem(IMP)

RISK FACTORS FOR CARBAPENEM RESISTANCE

There are a number of factors that predispose persons to infections by CR-GNB like immune-suppression, advanced age, admission to ICU, mechanical ventilation, previous exposure to antimicrobials, organ or stem-cell transplantation and prolonged hospital stay.[51]

Neuner *et al.* reported readmission of 72% patients who were discharged with CRKP-BSI at a hospital in Ohio, USA. [52]

Various studies reported increased carbapenem resistance in patients admitted in ICUs.[53, 54]

In study by Porwal *et al*, 50 patients with bacteremia caused by carbapenem resistant *E.coli*, CRKP,CRAB, carbapenem resistant *Pseudomonas aeruginosa*(CRPA) were identified and analyzed. The most common co-morbid condition was diabetes mellitus (30%), followed by chronic kidney disease (22%). Patients had mean 11.76 days of intensive care unit (ICU) care and mean time to onset of bacteremia was 6.4 days after admission. Patients with combination treatment had lower mortality (44.8%) compared with colistin monotherapy. Notably only 40% of patients had received carbapenems, but all had antibiotic exposure, suggesting that prior antibiotic exposure may be more important risk factors for developing CR infections.[44]

EPIDEMIOLOGY OF CARBAPENEMASE PRODUCING ORGANISMS

Across the globe, first reports of carbapenemases occurred in the 1980s when Japan reported the first carbapenemase from an *Aeromonas hydrophila* isolate. Sequentially, followed in London (1982)

by Seoul imipenemase (SME-1) from *Serratia marcescens*, imipenemases (IMI-1) in California (1984) and NMC-A in France (1990), both from *Enterobacter cloacae.* [55]

The first acquired MBL, IMP-1, was reported in *Serratia marcescens* in Japan in 1991.[56]

KPC was identified in 1996 in the United States.[57] Within a few years, KPC producers spreaded globally.

The first identified OXA-48 producer was a *K. pneumoniae* strain isolated in Turkey in 2003.[58] A point mutant analog of OXA-48, OXA-181, with similar carbapenemase activity, was identified in strains from India or of Indian origin.[59]

In early 2008, Sweden identified multidrug-resistant KPC-positive isolates, this time with a different MBL enzyme.[60]

NDM-1–positive Enterobacteriaceae are now the focus of worldwide attention. There are fresh fears and challenges on-going and under discussion by researchers as to how to curb the spread of carbapenem resistance across the globe.

LABORATORY DETECTION OF CARBAPENEM RESISTANT ORGANISMS

Detection of CR isolates has been difficult due to differences in their genetic makeup within and across countries.

The presence of a carbapenemase enzyme can be detected by a number of methods in clinical laboratories. These include automated systems (VITEK) or disc diffusion, MICs, selective agar(CHROMagar), modified Hodge test, synergy tests (e.g., E-tests or double disc tests), spectrometrics, whole genome sequencing and molecular methods. The genes controlling carbapenemase production are transferrable by plasmids. Currently, detection of the enzymes is difficult because of the different mechanisms involved and unreliable techniques practiced in some clinical laboratories.[61]

Several molecular techniques have been developed for characterization of these bacterial pathogens like multi-locus sequence typing, multi-locus enzyme electrophoresis, DNA fingerprinting

methods such as pulsed field gel electrophoresis, amplified fragment length polymorphism, multiple locus variable-number tandem repeat analysis, Whole Genome Sequencing (WGS).

A study by Sparbier *et al.* described the use of matrix-assisted laser desorption ionisation time-of-flight mass spectrometry (MALDI-TOF MS) as a new tool for detecting resistance patterns in bacteria from fresh positive blood cultures. The laser-based ionisation technique can detect changes in mass to charge ratios.[62]

A study was conducted in the Department of Microbiology, Armed Forces Institute of Pathology Rawalpindi Pakistan. Modified Hodge test was performed on 200 isolates, 138 (69%) were positive for carbapenemase production. Out of 138 MHT positive organisms, *E. coli* was 38%, followed by *Pseudomonas aeruginosa* (30%), *Klebsiella pneumoniae* (17%), *Acinetobacter baumannii* (12%), *Citrobacter diversus* (2%) and *Enterobacter agglomerans* (1.4%).[63]

Another study was carried out in Greece in 2007 to evaluate different laboratory tests for detection of MBLs in Enterobacteriacae. Modified Hodge test detected 98% cases keeping Polymerase chain reaction (PCR) as the gold standard while only 0.03% was detected as false positive.[64]

In a study by S Nagaraj *et al.*, a total of 51 clinical isolates of *Escherichia coli* and *K. pneumoniae*, identified as CR, were included in the study. MBL production was detected using Combined Disc Diffusion test by using Imipenem (10 µg) and 0.1 M ethylenediaminetetraacetic acid (EDTA; 292 µg). This was complemented by the MHT and the Double-Disc synery test with imipenem (10ug) and + EDTA(750ug) for all the isolates. 51 isolates resistant to meropenem by disc diffusion method were selected. This finding correlated with MIC values obtained by the MIC assays for meropenem. The presence of the MBL was best detected by Combined Disc Diffusion and Double Disc Diffusion as compared to MHT. Of the 36 *K. pneumoniae* isolates, 27 (75%) were blaNDM positive and 5 were blaVIM positive by PCR. Out of 15 *E. coli* isolates,

10 were blaNDM positive and 2 were blaVIM positive by PCR. In this study, blaKPC was not detected from any of carbapenem-resistant isolates.[65]

Baran I *et al.* conducted a study, at a tertiary care hospital in Turkey to investigate the phenotypic and genotypic features of CRE strains. A total of 181 CRE strains were included in the study. Antimicrobial susceptibility rates were tested using VITEK 2 system. MHT was performed using meropenem and ertapenem discs. MBL antimicrobial gradient test (E-test MBL strips) were used for evaluation of MBL production. A multiplex PCR was used for detection of carbapenems resistance genes (IMP, VIM, KPC, NDM-1 and OXA-48).92 of the isolates were MDR. 110 isolates were MHT with meropenem (MEM-MHT) positive and 109 isolates were MHT with ertapenem (ERT-MHT) positive. Nine of the isolates were positive with E-test MBL strips. The OXA-48 gene was detected in 86 strains, NDM-1 gene in 6 strains, VIM gene in 1 strain. IMP and KPC genes were not identified. The sensitivity of MEM-MHT and ERT-MHT for detection of OXA-48 was 70.9 and 70.6 %. The sensitivity of E-test MBL for NDM-1 was 66.7 %.[66]

A study by Sakarikou *et al.*, used MALDI-TOF MS method to rapidly detect carbapenemase-producing *Klebsiella* isolates from blood cultures and to obtain proteomic profiles to discriminate between carbapenemase-producing and non-carbapenemase-producing strains.[67]

In a study conducted by Mahadevan Kumar *et al.*, aspirate from positively flagged blood culture bottles was subjected to differential centrifuge. All gram-negative bacilli on gram stain from the deposit were processed in Xpert® Carba-R and inoculated on CHROMagar. The presence of genes and growth on CHROMagar was compared with carbapenem resistance on VITEK-2 Compact. A total of 119 GNB isolates were processed. One or more of the carbapenemase genes were detected in 80 isolates.[68]

Carbapenem resistance among GNB, members of Enterobacteriaceae such as *Escherichia coli, Klebsiella spp., Enterobacter spp., Proteus spp.,* and among non-lactose fermenters, *Pseudomonas spp.*, and *Acinetobacter baumannii* are being reported with increasing frequencies worldwide. Treatment options for infections caused by these pathogens are limited.

CARBAPENEM RESISTANCE

A molecular study was conducted by Srujana mohanty *et al.*for the presence of carbapenem resistance by standard disk-diffusion method and MIC breakpoints using the CLSI guidelines. Consecutive, non-duplicate isolates of *Escherichia coli* and *Klebsiella pneumoniae* from clinically diagnosed BSIs were screened. Carbapenemase-encoding genes were amplified by PCR. Of 387 isolates (214 *K. pneumoniae*, 173 *E. coli*) tested, 93 (24.03%) were found to be CRE out of which 63.4% were *Klebsiella spp*. Of these, 71 (76.3%) were positive for at least one tested carbapenemase gene.The frequency of carbapenemase genes was NDM-1(65.6%), oxacillinase (OXA)-48 (24.7%), OXA-181 (23.6%), Verona integron-encoded metallo-β-lactamase (6.4%) and *K. pneumonia* carbapenemase (2.1%). Their study identified presence of carbapenemases in a large proportion of CRE isolates.[(12)]

New Delhi metallo-beta-lactamase (NDM)-mediated carbapenem resistance in *Pseudomonas aeruginosa* and *Acinetobacter baumannii* is also a major concern.

Study by Mohibur rahman *et al.* investigated the presence of NDM and its variants in *P. aeruginosa* and *A. baumannii* at a tertiary hospital in North India. A total of 236 isolates (130 *P. aeruginosa* and 106 *A. baumannii*) were included; 38 (29.23%) *P. aeruginosa* and 20 *A. baumannii* isolates (18.8%) were resistant to carbapenems. All 38 carbapenem-resistant *P. aeruginosa* harbored $bla_{NDM-1,}$ while 12 (60%) of 20 *A. baumannii* harbored bla_{NDM-2}.[(69)]

Datta *et al.* reported a low CRE prevalence rate of 7.87% from a study conducted in a tertiary care hospital in North India[(70)] while Gupta *et al.*

reported carbapenem resistance varying from 17 to 22% among Enterobacteriaceae strains.[71] Wattal *et al.* reported a high CRE prevalence rate ranging from 13 to 51% in a tertiary care hospital in Delhi.[72] Study by K. Sreeja Vamsi *et al.* showed 56% carbapenem resistance in *Klebsiella* followed by *Pseudomonas* (24%).[73]

Study done by A.Xul et al. reported highest carbapenem resistance to *Acinetobacter spp.* (53.5%) followed by *Pseudomonas spp*.[53]

While in study by Nazneen S *et al.* carbapenem resistance was highest among *Pseudomonas* (25%) and *Klebsiella*(25%) followed by *Acinetobacter* (22%).[74] Authors from different parts of India have reported varying resistance rates of carbapenem in Enterobacteriaceae ranging from 5.75% to51% in various GNBs over a decade.[75]

These resistant pathogens have become significant threat to public which has led to the use of antibiotics such as colistin as the treatment option.

COLISTIN

DISCOVERY AND HISTORY:

The occurrence of MDR and XDR bacteria has led to the reuse of polymyxin, a last-resort drug against severe bacterial infections.

Polymyxins are non-ribosomal, cyclic oligopeptides antimicrobials which were discovered in 1947 from *Paenibacillus polymyxa*. Structurally comprised of a cyclic heptapeptide with five major chemical compounds: polymyxins A, B, C, D, and E. These compounds are differentiated based on variation in their amino acid sequences and fatty acid side chains. The most common polymyxins that have been used in clinical practice are polymyxin B and polymyxin E (colistin).

Colistin is a polypeptide antibiotic isolated in 1947 from the bacterium *Paenibacillus polymyxa* subspecies *Colistinus.*

Thereafter, it was reported from Japan (1947) that colistin is a secondary metabolite of the Gram-positive bacteria *P. polymyxa* subspecies *Colistinus.*[16]

In the 1950s, colistin was used as an intravenous formulation. In 1959, the US Food and Drug Administration approved colistin to treat

diarrhea and urinary tract infections and increasingly being administered adjunctively via a nebulizer to treat pulmonary infections.[27]

Both, colistin and polymyxin B differ in structure only by one amino acid at position 6 (-Leu in colistin, while -Phe in polymyxin B).[76]

Table 2: Main events related to colistin

Year	Event
1947	Discovery of polymyxins from bacteria *Paenibacillus polymyxa*
1949	Colistin (polymyxin E) was first time isolated from *Bacillus polymyxa var. colistinus* by Koyama Y. and colleagues in Japan
1959	Colistin became available in intravenous formulation (as colistimethate sodium) for clinical uses
1960s–1970s	Colistin used for gram-negative infection; later on, uses decline due to its toxicities
1990s–2000s	Used mainly for lung infection due to MDR gram-negative pathogens in patients with cystic fibrosis
2000 onwards	Currently in use to treat healthcare-associated MDR gram-negative infection

AVAILABLE FORMS OF COLISTIN

Commercially, there are two available forms of colistin: colistin sulfate for oral and topical use and CMS for parenteral use, as it is less toxic than colistin sulfate[77-79]

Colistimethate sodium (CMS) is an inactive prodrug of colistin, and is less toxic than colistin when administered parentally. The pharmacokinetics (PK) of CMS and colistin are distinct: CMS predominantly exhibits a renal mode of excretion and its PK are best described by a two-compartment kinetics model, while colistin follows a one-compartment model with elimination primarily via non-renal

mode.[80] The use of intravenously administered CMS was stopped because of its association with serious adverse events, particularly nephro- and neurotoxicities.[81]

Inhaled colistin is used for treating pneumonia/ventilator associated pneumonia (VAP) due to MDROs and also used prophylactically in patients with cystic fibrosis.

PHARMACOKINETICS

Colistin sulphate has an active antimicrobial activity. Half-life of colistin sulphate is 4hrs and is highly stable. CMS is non-active pro-drug with half-life of 2hrs. CMS not being constant both in vivo and vitro because it is hydrolyzed by chemical derivatives.[60] About two thirds of CMS is eliminated as unchanged mainly by the renal route within 24 h[77,78] while elimination of colistin is non-renal and non-biliary route.

Dose adjustment for colistin in renal dysfunction is necessary, as there is reduced renal dependent elimination of its pro-drug CMS which ultimately lead to increased colistin level.[78,79] It has shown persistant levels in the liver, kidney, heart, and muscle, while poor distribution to the bones, cerebrospinal fluid, lung parenchyma, and pleural cavity.[77,78]

MECHANISM OF ACTION

Colistin is positively charged which binds through electrostatic interaction to the negatively charged phosphate groups of lipid A, an important component of LPS of GNB. The lipid A plays a crucial role in bacterial permeability and exchange with cell exterior. Colistin displaces the divalent cations of calcium (Ca^{2+}) and magnesium (Mg^{2+}) in a competitively way, impairing the LPS three-dimensional structure. The permeabilization of outer membrane(OM) occurs, allowing colistin to get through OM. The phospholipid bilayer, present in Gram-negatives, loses its stability, because of the action of colistin by including hydrophilic groups in the fatty acid chains, changing its integrity and leading to its destruction. Failure to maintain cellular

content leads to cell lysis. Colistin also prevents the induction of shock by endotoxinby exerting an anti-endotoxin activity.[16]

TOXICITY AND ADVERSE EFFECTS

Two types of toxicity, namely, nephrotoxicity and neurotoxicity have been reported with the uses of colistin. The observed nephrotoxicity was as high as 50% in old studies versus 15%–25% in recent studies. The definition of nephrotoxicity was not standardized between the studies.[82]

Renal toxicity of colistin has been described as dose dependent and may be partly due to their D-amino acid content and fatty acid component that leads to acute tubular necrosis.[64]

Age (more than 60 years) has also been found as a significant risk for colistin-induced nephrotoxicity.[83]

In a recent preliminary study on high-dose colistin (9 MIU twice-daily) administration in critically ill patients found that AKI developed during 18% of treatment courses did not require renal replacement therapy (RRT) and subsided within 10 days from colistin discontinuation.[84] Also, there was no correlation between variations in serum creatinine level and daily and cumulative doses of colistin or duration of colistin treatment. In another study, Dewan *et al.* also reported AKI in 16% of patients in whom high dose, extended interval colistin (9 MIU stat followed by 4.5 MIU 12 hourly) was used, while no patient required RRT.[85]

Overall incidence of neurotoxicity related to colistin use is less than the nephrotoxicity. Earlier studies reported paresthesias in about one fourth of patients receiving colistin, with few case reports of neuromuscular blockade or apnea, while recent studies did not reported any significant neurotoxicity.[82,86]

SPECTRUM OF ACTIVITY OF COLISTIN

Colistin has narrow antibacterial spectrum, mainly to most clinically significant Gram-negative bacilli, including members of the Enterobacteriaceae (*Citrobacter* spp., *Enterobacter* spp., *Escherichia* coli, *Klebsiella* spp., *Salmonella* spp., and *Shigella* spp.) and

nonfermentative bacteria (*Acinetobacter* spp., P. aeruginosa, and most strains of *Stenotrophomonas maltophilia*).[87]

Table 3: Spectrum of activity of colistin among various Gram negative bacteria

	Gram-negative bacteria(86)	
Susceptible	**Resistant**	**Variable**
Gram-negative bacilli: *Pseudomonas aeruginosa*, *Acinetobacter* spp., *Escherichia coli*, *Klebsiella* spp., *Enterobacter* spp., *Citrobacter* spp., *Salmonella* spp., *Shigella* spp., *Haemophilus influenza*, *Bordetellapertusis*, *Legionella pneumophila*	Gram-negative bacilli: *Proteus* spp., *Providencia* spp., *Morganellamorgani*, *Serratia* spp., *Edwardsiellatarda*, *Burkholderia* spp., *Brucella* spp.	Gram-negative bacilli: *Stenotrophomonas maltophilia*, *Aeromonas* spp., *Vibrio* spp.
	Gram-negative cocci: *Neisseria gonorrheae*, *Neisseria meningitides*, *Moraxella catarrhalis*	

USES OF COLISTIN

Colistin is a key antibiotic used to treat MDR-GNB infections.

From the early 1970s to the mid-1990s, polymyxins were topically administered for prophylaxis of GNB pneumonia.

In the early 2000s, intravenous[88, 89] and nebulized[90] colistin became increasingly used to treat VAP and ventilator-associated tracheobronchitis (VAT) caused by MDR-GNB.

Previous studies have shown that colistin can effectively cure osteomyelitis induced by carbapenemase-producing *Klebsiella pneumonia.*[91]

It is also used for urinary tract infections triggered by XDR *Pseudomonas aeruginosa.*[92]

A study was conducted on 186 critically ill patients on mechanical ventilation for > 48 h.84 patients received nebulized CMS and 84 received nebulized saline during the same period. Nebulized CMS significantly reduced the incidence of MDR-GNB VAP and improved the survival rate of patients with VAP and without evidence of increased resistance to colistin.[93]

MECHANISMS OF COLISTIN RESISTANCE IN ENTEROBACTERIACEAE

GNB employ several mechanisms of resistance against colistin. According to the literature, most colistin-resistance mechanisms are adaptive that occur after in vitro exposure.[16]

Resistance to colistin occurs by LPS modification through alteration of the LPS and reduction in its negative charge.[94,95] The other strategy is the overexpression of efflux-pump systems.[96] and overproduction of capsule polysaccharide.

Acquired resistance mechanisms in Enterobacteriaceae

Acquired colistin-resistance mechanisms have been recognized in some members of Enterobacteriaceae family, such as *E. coli, Salmonella spp*., *Klebsiella spp*., and *Enterobacter spp.,* and remain unknown for other bacterial species.[97] Only one mechanism of

resistance has been identified as a transferable mechanism (plasmid-mediated mcr gene) so far (Table below).[98]

Acquired and intrinsic strategies employed by Gram-negative bacteria for achieving resistance to colistin

Table 4: Mechanisms of colistin resistance in members of Enterobacteriaceae family.

Genes	**Gene function**	*E. coli*	*K. pneumoniae*	*Enterobacter*sp.	*Salmonella* spp.	*C. freunddii*	*Proteus mirabilis*
pmrA/*pmrB*	Modification of lipid A by *arnBCADTEF* operon, *pmrC* and *pmrE* genes	+	+	+	+	−	−
phoP/*phoQ*	Modification of lipid A by activation of the *pmrHFIJKLM* operon/activation of pmrAB by *pmrD*	+	+	+	+	−	−
arnBCADTEF	Modification of lipid A by pEtN and L-4AraN	+	+	+	+	−	+
mgrB mutation	Overexpression of *phoPQ* and activation of *pmrHFIJKLM*	+	+	−	−	−	−
ramA	Modulates lipid A biosynthesis	−	+	−	−	−	−
crrB mutation	Modification of lipid A by upregulation of *pmrAB*/activation of the glycosyltransferase	−	+	−	−	−	−
mcr1	Phosphoethanolamineteransferase	+	+	+	+	+	−

mcr2	Phosphoethanolamineteransferase	+	−	−	+	−	−
mcr3	Phosphoethanolamineteransferase	+	−	−	+	−	−
mcr4	Phosphoethanolamineteransferase	+	−	+	+	−	−
mcr5	Phosphoethanolamineteransferase	+	−	+	+	−	−
mcr6	Phosphoethanolamineteransferase	−	−	−	−	−	−
mcr7	Phosphoethanolamineteransferase	−	+	−	−	−	−
mcr8	Phosphoethanolamineteransferase	+	+	−	−	−	−
acrB mutation	Efflux pump	+	+	−	−	−	−
KpnEF mutation	Efflux pump	−	+	−	−	−	−
sapABCDF mutation	Efflux pump	−	−	−	−	−	+

ACQUIRED RESISTANCE MECHANISMS IN *ACINETOBACTER*

A. baumannii is an emerging, opportunistic, GNB pathogen. Outbreaks, due to *A. baumannii* strains especially in ICU settings, have been reported in numerous countries around the world. In MDR strains of *A. baumannii*, colistin is often the only remaining treatment. Although colistin resistant clinical isolates have already been reported, but some *A. baumannii* isolates have been shown to display heteroresistance to colistin.[99]

Colistin resistance in *A.baumannii* can occur by two distinct mechanisms like complete LPS loss or modification of lipid A. Loss of LPS production in *Acinetobacter* spp. can result from inactivation of lipid A biosynthesis genes, *lpxA*, *lpxC*, or *lpxD* and that colistin resistance occurs via loss of lipid A.[100]

The results of a study in France in 2015 on A. *baumannii* indicated that chromosomal resistance is associated with the loss of 47,969 bp genomic regions containing modA and ppk (genes involved in biofilm formation in *Pseudomonas*), according to whole genome sequencing results.[101]

There have been numerous reports of colistin resistance in *Acinetobacter baumannii* isolates and, to a lesser degree, among *P.aeruginosa* isolates.[29]

ACQUIRED RESISTANCE MECHANISMS IN PSEUDOMONAS

MDR *Pseudomonas aeruginosa* strains are increasingly isolated from clinical specimens worldwide.Colistin is the only effective antibiotic in some cases of *Pseudomonas aeruginosa* resistance to all tested antibiotics, even carbapenem. Colistin resistance could be plasmid borne(mcr-1 and mcr-2 genes) or through biofilm formation.[16]

GLOBAL PREVALENCE OF COLISTIN RESISTANCE

Colistin (CT) is a last-resort antibiotic used mainly for the treatment of infections caused by MDR-GNB.[16]

Colistin-resistant *Acinetobacter* spp. was first reported in the Czech Republic in 1999.[102] Number of reports all over the world had increased year by year. In 2006 Li *et al*. first described colistin heteroresistance of *A. baumannii*, which was defined as the emergence of resistance to colistin by a subpopulation from an otherwise susceptible (MIC ≤2 mg/L) population.[103] A study by Ali Pormohammad *el al.* showed prevalence of colistin resistance higher in South-East Asia and Eastern Mediterranean countries than other regions of the world. Lebanon and China had the highest and Germany had the lowest rate of resistance for colistin.[104] One study in Kuwait in 2016 found that 8% of *K. pneumoniae* isolates from different sources, including urine and blood, had resistance to colistin with an MIC of 4 and 48 mg/L, respectively.[105] Two years later, a similar study reported that 3 out of 39 isolates (7.7%) were resistant to colistin.[106] Indian studies have reported varied prevalence of colistin resistance ranging from 1.1% to 38.3%.[16, 22,107] A study by Santimaleeworagun W et al. reported forty out of 623 isolates (6.4%) as colistin resistant GNB. The colistin resistant GNB prevalence rates among *E.coli, K.pneumonia, A. baumannii*, and *P. aeruginosa* were 2.9%,17.3%, 5.0%, and 1.6%, respectively. These colistin-resistant isolates were susceptible to amikacin, gentamicin, and tigecycline[108] Parul Gupta *et al* at Jaipur, Rajasthan reported 5/100(5%) isolates colistin resistant by BMD method. Out of five resistant isolates, two isolates had MIC of 4 mg/ml while three isolates had MIC of 8 mg/ml. Resistant isolates included two *K.pneumonia*, two *P. aeruginosa* and one *A. baumannii*.[109] Bakthavatchalam YD at CMC, Vellore reported 14.9% colistin resistance in Gram negative isolates over 3 year study period with 20.6% and 9.1% resistance in *Klebsiella* and *Acinetobacter* respectively.[110] Study by Laura J Rojas *et al*, reported higher percentage (13%) of colistin resistance among patients with CRKP.[111]

Anan MMG et al. at Cairo, Egypt reported very high (53%) colistin resistance in their study.[112] Colistin resistance has become even more problematic in other countries. For example, a multicenter study from

Italy demonstrated that 43% of carbapenemase-producing *K. pneumoniae* isolates were colistin resistant.[113] A 6 years study at Los Angeles reported, 128(0.45%) Gram negative isolates colistin resistant and 68(1.5%) of these were colistin resistant *K. pneumoniae* isolates.[114] Enterobacteriaceae with NDM-1 carbapenemases are highly resistant to many antibiotic classes like β-lactams, fluoroquinolones, and aminoglycosides—the main antibiotic classes for the treatment of Gram-negative infections.[115]

In another study by Mohammad Qadi *et al.*, Clinical Enterobacteriaceae isolates were obtained from microbiology laboratories of the hospitals of different geographical locations in Gaza Strip. They were tested for their AST by the disk diffusion method and the MIC method for colistin. The highest resistance to colistin was found to be among the *Proteus* spp. (63.2%), followed by *Serratia* spp. (57.1%) and lowest was observed among *Klebsiella* isolates (31.6%). Only 39.0% of meropenem-resistant Enterobacteriaceae was susceptible to colistin, while 45.8% of imipenem-resistant Enterobacteriaceae was susceptible to colistin. The overall resistance to colistin was high (41%) among tested clinical isolates.[116]

Colistin resistance among MDR GNB is crucial due to lack of antibiotics for the treatment. Sherry N. *et al.* reported overall higher rates of colistin resistance in *K. pneumoniae* than in *E. coli.* Not surprisingly, the prevalence of colistin resistance among *A. baumannii* and *P. aeruginosa* isolates in their study remained relatively low (*A. baumannii* 2.4%–4.8% and *P. aeruginosa* 0%–1.4%). Additionally, even meropenem-non-susceptible, MDR and extensively drug resistant (XDR) *Pseudomonas aeruginosa* and *A. baumannii* isolates have maintained low colistin resistance rates.[117]

There have been no reports about colistin resistance among *K. pneumoniae* isolates for the last 5 years in Iraq, Yemen, Syria, Jordan, Palestine, Egypt, Oman, Qatar, Bahrain and Cyprus.[118]

RISK FACTORS FOR COLISTIN RESISTANCE

A study by DafopoulouK *et al*. observed association between colistin resistance and increased mortality. Number of days in hospital, male gender, skilled nursing residence, black race, increased age, Elixhauser score, and end-stage renal disease were each significantly associated with increased risk of colistin-resistance.[119]

Papp-Wallace KM *et al*. identified multiple risk factors for colistin resistance in gram negative isolates, including recent prior hospitalization, prior carbapenem resistance, prior treatment with colistin, exposure to chlorhexidine, the presence of multiple comorbidities in the patients, and increasing age, male sex, length of hospitalization, and the presence of indwelling urinary catheters. Other risk factors for the development of MDROs in general included prior residence in a nursing home, hemodialysis, ICU admission, the presence of a medical comorbidity, and prior beta-lactam usage and invasive surgery.[120]

ANTIMICROBIAL SUSCEPTIBILITY TESTING FOR COLISTIN

Optimizing and standardizing susceptibility testing for the polymyxins has become a major issue for Gram negative bacilli.

It is influenced by multicomponent composition of colistin; brand-to-brand/batch-to-batch variation in the composition, cationic property of colistin attributing to adherence to the microtiter plate and heteroresistance to colistin.[121]

Colistin sulfate is recommended in ST instead of CMS[3, 78] because CMS is an inactive pro-drug and undergoes variable hydrolysis resulting varying susceptibility (MIC)report. Hence, ST should be performed only with colistin sulphate.

Tan and Ng compared the performance of multiple colistin disk diffusion methods to that of the reference agar dilution method and demonstrated that the majority of colistin-resistant isolates were called falsely susceptible by all disk diffusion methods.[122]

Several studies in the literature have reported considerable discrepancies of the MICs produced by gradient tests (E-test and MIC test strips), causing variations in colistin AST results.[1, 123]

Because of these high rates of very major errors (in which an isolate is called susceptible when it is resistant by the reference method), no CLSI disk diffusion breakpoints exist for the polymyxins.

An accurate method for antimicrobial susceptibility testing (AST) of colistin (polymyxin E) is crucial in an era of increasing numbers of MDR-GNB.

Based on the poor performance of these commonly used methods, CLSI do not recommend using disk diffusion or gradient diffusion for colistin susceptibility testing and instead recommend using BMD method.[124]

BROTH MICRODILUTION METHOD(BMD)

BMD is the reference susceptibility test method recommended by Clinical and Laboratory Standards Institute (CLSI) and the European Committee on AST (EUCAST).[125]

According to CLSI recommendations, BMD is performed with cation-adjusted Muller-Hinton broth (CA-MHB), a range of 2-fold dilutions.[126]

However, BMD of colistin is associated with methodological issues. Colistin binds to the plastic of polystyrene trays resulting in reduced antibiotic concentration and attempts have been made to prevent this by adding a surfactant, such as polysorbate-80, to the test system.[16]

Thus, testing is performed using the sulphate salt of colistin and standard polystyrene trays without the addition of surfactants.[126]

E. Matuschek *et al.* performed colistin MIC on five commercially available BMD products (Sensititre, MICRONAUT-S, MICRONAUT MIC-Strip, SensiTest, and UMIC) and two gradient tests (Etest and MIC Test Strip). The colistin BMD products correlated well with reference tests, in particular for Sensititreand the two MICRONAUT products with essential agreement ≥96%, 96% and 99%. The results were somewhat poorer for the BMD products SensiTest and UMIC with EA 88% and 82% respectively, and considerably poorer for the

gradient tests (EA 43-71%). The gradient tests generally underestimated colistin MICs, resulting in a significant number of false susceptible results.[127]

Simner and colleagues in their study reported the performance of the colistin broth disk elution (CBDE) test for assessing the susceptibility of Gram-negative bacteria to colistin. This test evaluated 172 *Enterobacteriaceae*, *A. baumannii*, and *P. aeruginosa* isolates, including 38 isolates that were colistin resistant, by comparing the results of CBDE with BMD. They found a categorical agreement of 98%, an essential agreement of 99% (MIC within a single doubling dilution), and no major errors (in which the organism is called resistant when it is susceptible by the reference method). They did find an 8% very major error rate, and this was because three of the six *Escherichia coli* isolates with *mcr-1* that had MICs of 4 µg/ml by BMD(resistant) had MICs of 2 µg/ml by CBDE (susceptible).[128]

The results from Simner *et al.* are highly encouraging because they suggest that this simple test can reliably identify *Enterobacteriaceae*, *A. baumannii*, and *P. aeruginosa* isolates that have chromosomally mediated colistin resistance, the most common mechanism of colistin resistance.[128]

There is an urgent need for a simple, practical, and inexpensive method for colistin susceptibility testing method. Therefore, it is crucial that clinical microbiology laboratories be able to identify CR-GNB that are resistant to colistin, so that patients do not receive this nephrotoxic therapy when it is unlikely to be effective.

MATERIALS AND METHODS

The present study was a prospective, observational study carried out in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana for a period of one year i.e. from 1st January 2020 to 31st December 2020.The study was approved by the institutional ethics committee.

Source of data

All Gram negative isolates from blood samples received from indoor patients from our hospital during course of study.

For each patient, only one bloodstream infection episode and, for each episode, only the first sample was considered. In the case of two or more episodes observed in the same patient, only the first was considered.

Inclusion criteria

•All Gram negative bacterial isolates from blood samples of the admitted patients.

Exclusion criteria:

•All samples from the OPD patients.

•All Gram positive isolates obtained from the blood samples.

Data Collection

The following data was collected:-

- Patient detail including: Name, Age, Sex, Date of admission to hospital
- Provisional diagnosis
- Comorbid illness and underlying ds
- Risk factors
- Date & time of collection of sample
- Specimen lab ID No.
- Microbiological evaluation –identification of the isolate, AST
- Outcome of patient

SAMPLE COLLECTION:-

Under all aseptic conditions 5-10ml (adults) and 1-3ml (pediatric) of blood sample was withdrawn from antecubital vein with a disposable syringe and was inoculated directly into commercially prepared BACTEC 9240 or BacT/ Alert culture bottles.

The samples were transported immediately to the laboratory.

PROCESSING OF SAMPLES:-

The samples received in the microbiology lab were processed as per standard protocols. The blood culture bottles were loaded for a maximum period of 7 days or till the bottle flagged positive by the system and time of positivity was noted.

- The Bac-T/Alert microbial detection system utilizes a calorimetric sensor and reflected light to monitor the presence and production of CO2 that is dissolved in the culture medium. If microorganisms are present in the test sample, CO2 is produced as the organisms metabolize and substrate in the culture medium. When growth of the microorganism produces CO2, the color of the gas-permeable sensor installed in the bottom of each culture bottle changes from blue green to yellow.
- The BACTEC uses fluorescent light to detect changes in the concentration of CO2 in the blood broth mixture. When the growth of microorganism produces CO2, its sensor emits a fluorescent light that passes an emission filter on the way to a light sensitive diode.

PROCESSING OF BLOOD CULTURE POSITIVE BOTTLES:-

Smears were prepared from positive blood culture bottles and Gram staining of smears was done. Positive bottles were sub-cultured on MacConkey's and Blood agar plates. The plates were incubated at 37°C for 18-24hrs.

Media used

1. Blood Agar: The medium was prepared by adding 5-10% sterile animal (sheep) blood to sterile 2% nutrient agar (peptic digest of animal tissue, NaCl, beef extract) that was melted and cooled to

50°C. Double layered blood agar was prepared. A thin layer of melted nutrient agar, about 7 ml for a 9 cm petri dish, was poured and allowed to set. Then a thin layer of 5% blood agar was poured on top of the first layer.

2. MacConkey's Agar: Peptone 20g, Sodium taurocholate 5g, Water 1L, Agar 20g, Neutral red solution, 2% in 50% ethanol 3.5ml, Lactose, 10% aqueous solution 100ml

The medium was prepared by dissolving the peptone and taurocholate(bile salt) in the water by heating. Then the agar was added and dissolved in the steamer or autoclave. pH was adjusted on 7.5. Lactose and neutral red were shaken, mixed, added. The medium was heated in the autoclave with free steam(100°C) for 1hr then at 115°C for 15min and then poured into plates.

IDENTIFICATION:-

Growth was identified by the colony characteristics, Gram staining and the VITEK 2 system. Suspensions were prepared by emulsifying bacterial isolates in 0.45% saline to the equivalent of a 0.5 McFarland turbidity standard.

The same suspension was used for identification and AST for the VITEK 2 system.

The 0.5McFarland bacterial suspension was diluted to 1.5 × 107CFU/ml in 0.45% saline. Cards were automatically filled, sealed and loaded into the VITEK 2 instrument for incubation and reading. Only clinically significant isolates, taking into account organism identification and clinical parameters were included. Identification of the Gram negative organisms was done by using BioMerieux VITEK-2 GN card for lactose fermenters and non-lactose fermenters.

ANTIMICROBIAL SUSCEPTIBILITY TESTING (AST):-

The BioMerieuxVITEK AST-N405 card for lactose fermenters contained antibiotics amikacin, gentamicin, trimethoprim-sulfamethoxazole, ciprofloxacin,cefepime, ceftriaxone, cefuroxime,

amoxicillin / clavulanic acid, cefoperazone /sulbactam, piperacillin/tazobactam, imipenem, meropenem, and colistin.

The BioMerieuxVITEK AST-N406 card for non-lactose fermenters contained amikacin, gentamicin, ampicillin, ofloxacin, ciprofloxacin, cefepime, cefixime, ceftazidime, cefotaxime cefoperazone/sulbactam, piperacillin/tazobactam, imipenem, meropenemand colistin.

Results were interpreted as per CLSI (Clinical & Laboratory Standards Institute) guidelines.[129]

Cefuroxime, chloramphenicol and azithromycin were tested by Kirby bauer disc diffusion for *Salmonella spp.*

Quality control ATCC(American Type Culture Collection) strains of *Escherichia coli 25922, Pseudomonas aeruginosa 27853* were used as quality controls.

CHARACTERIZATION OF MICROORGANISMS:-

The isolates were further characterized on the basis of antibiotic resistance as follow.[40]

MDR: The isolates acquired non-susceptibility to at least one agent in three or more antimicrobial categories,

XDR: The isolates showed non susceptibility to at least one agent in all but two or fewer antimicrobial categories (i.e. bacterial isolates remain susceptible to only one or two categories)

PDR: The isolates showed non-susceptibility to all agents in all antimicrobial categories.

In *Salmonella spp.* multiple-drug resistance (MDR), defined as resistance to ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole.[129]

COLISTIN SUSCEPTIBILITY TEST

Carbapenem resistant (imipenem/meropenem) Gram negative isolates were further tested for colistin susceptibility by BMD method. CR Gram negative isolates intrinsically resistant to colistin were not tested by BMD.

BROTH MICRODILUTION METHOD:

BMD method was used to determine the MIC of colistin for carbapenem resistant Gram negative isolates.

BMD method was performed according to CLSI guidelines. All organisms intrinsically resistant to colistin such as *Stenotrophomonas, Burkholderia, Proteus, Serratia, Morganella and Providencia*were excluded.

BMD was performed with CA-MHB, a range of 2-fold dilutions.

The reference powder (colistin sulphate salt) of 30,000 units/mg and organism suspension of $5x10^5$ CFU/ml were used.

SPECIMENS: Isolated colonies (minimum of 3-5) of similar morphology were taken from non-selective medium (Muller Hinton agar) grown overnight at 35°C. Isolates were stored at -20°C, requiring two consecutive subcutures prior to testing.

REQUIRED MATERIALS:

- 96 well round bottom Microtiter plate
- Muller Hinton broth(CA MHB)
- Colistinsulphate
- Organism suspension(0.5 McFarland)

MEDIA:CAMHB was prepared with 2X strength since it gets diluted by 2 times.

For eg: weigh for 200ml, but add in 100ml distilled water.

DRUG: Colitin sulphate

According to CLSI, the reference powder should have 30,000units/mg

But the colistin sulphate powder of (SIGMA-ALDRICH) had 15,000units/mg

So to prepare 1mg/ml stock solution, we had weigh 2mg colistin powder and add 1ml autoclaved distilled water to it. This was considered as 1mg/ml stock and was used to make desired concentrations

And as we had to add 4X concentration in the well.

- For making 64ug/ml from 1mg/ml stock, we added 64µl of stock solution in 936µl of distilled water

- 25µl of this was added to the wells and the final concentration of the drug in the wells became 16µg/ml because drug gets diluted by 4 times in the well.
- 2-fold serial dilution of the 64µg/ml (500µl of 64µg/ml in 500µl distilled water) was done to achieve a concentration of 32ug/ml, 16µg/ml, 8µg/ml, 4µg/ml(final conc. In well 16µg/ml, 8µg/ml, 4µg/ml, 2µg/ml respectively) for test organism and upto 1µg/ml (final conc.0.5µg/ml) for controls.

PREPARATION OF INOCULUM: Saline suspension was prepared of the isolate from an overnight incubated agar plate to obtain 0.5McFarland turbidity.

Organism suspension preparation:-

According to CLSI, the organism in the well should be 5×10^5CFU/ml

Now 0.5McF= 1.5×10^8 CFU/ml, therefore to calculate dilution of organism in well.

1.5×10^8 CFU/ml = 300 times 5×10^5CFU/ml

As, the organism in the well dilutes 4X, so we had to prepare 75 times dilution of 0.5McF. We took 10µl of 0.5McF organism and 740µl distilled water to it. Then 25µl of this was added in the well. The final concentration of organism became 5×10^5 CFU/ml

Procedure

- 25µl of colistin in the well was added
- 25µl of organism suspension in the well was added
- 50µl of MHB media(2x strength) was added
- The total volume in each well of 96 well microtitre plates was 100µl
- One column constituted, bacterial control i.e. inoculum + media
- Another column constituted sterility control i.e. drug + media
- One row constituted QC strain *Ecoli* ATCC 25922 + media + drug
- One more row was for mcr-1 strain NCTC 13846 *Escherichia coli* + media + drug

- After adding media, drug and organism to the plate was incubated overnight at 37˚ C

Table 5: Volume of components added per well.

COMPONENTS	VOLUME PER WELL
MHB media(2X strength)	50µl per well
DRUG	25µl
ORGANISM SUSPENSION	25µl

Results were noted after 16-24hrs.

RESULTS AND INTERPRETATION

The purpose of this experiment was to check minimum inhibition concentration of colistin.

MIC is the lowest concentration of antimicrobial agent that completely inhibits growth of the organism.

According to the latest recommendations by CLSI in 2021, the results were interpreted.[130]

MIC was read as the lowest concentration where turbidity is not observed.

Table 6: Interpretation of results

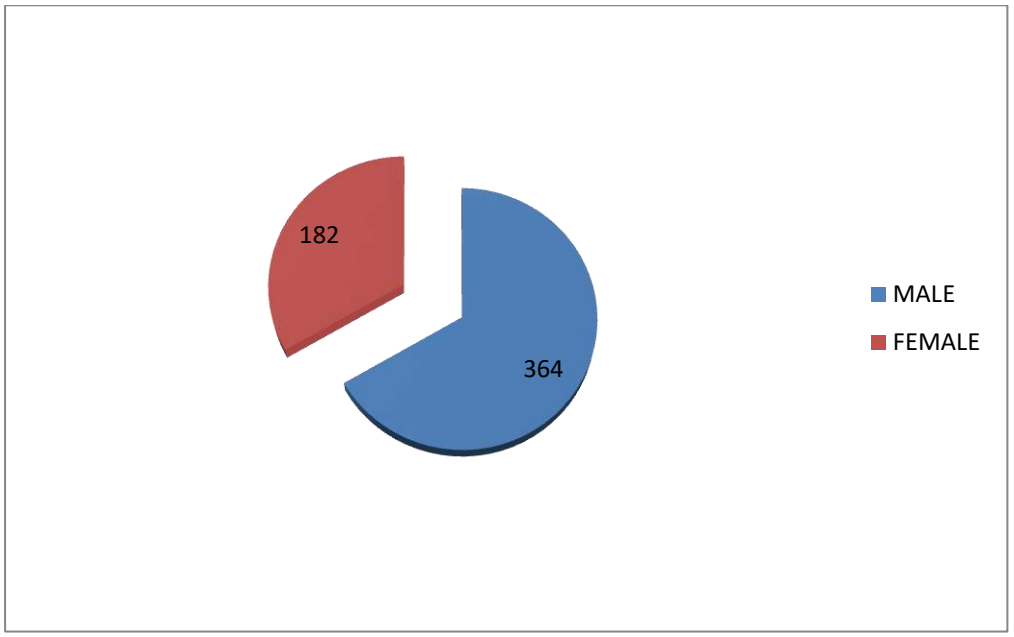
CLSI(2021)	*Enterobacterales/ Pseudomonas/ Acinetobacter*	
Colistin sensitivity	Intermediate	Resistant
MIC Breakpoints	≤2 µg/ml	≥ 4 µg/ml
QC STRAINS *Ecoli* ATCC 25922(susceptible) *Ecoli* NCTC 13846 (resistant mcr-1 gene positive)		

RESULTS AND OBSERVATIONS

This study was prospective study conducted over a period of one year(January 2020 to December 2020) in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana. A total of 14,175 blood samples were received for blood culture by automated blood culture (VITEK-2). Out of these, 720 samples were observed culture positive. Only the first episode of bloodstream infection (BSI) was analyzed and considered in the study.Out of the total 720 isolates obtained, 546 (75.8%) were Gram negative bacterial isolates. These Gram negative bacterial isolates were further identified and antimicrobial susceptibility pattern was determined by VITEK 2 system. The isolates were then characterized as multidrug resistance (MDR), extensively drug resistant (XDR) and pandrug resistant (PDR).Carbapenem resistant Gram negative isolates were further tested for colistin susceptibility by BMD method.

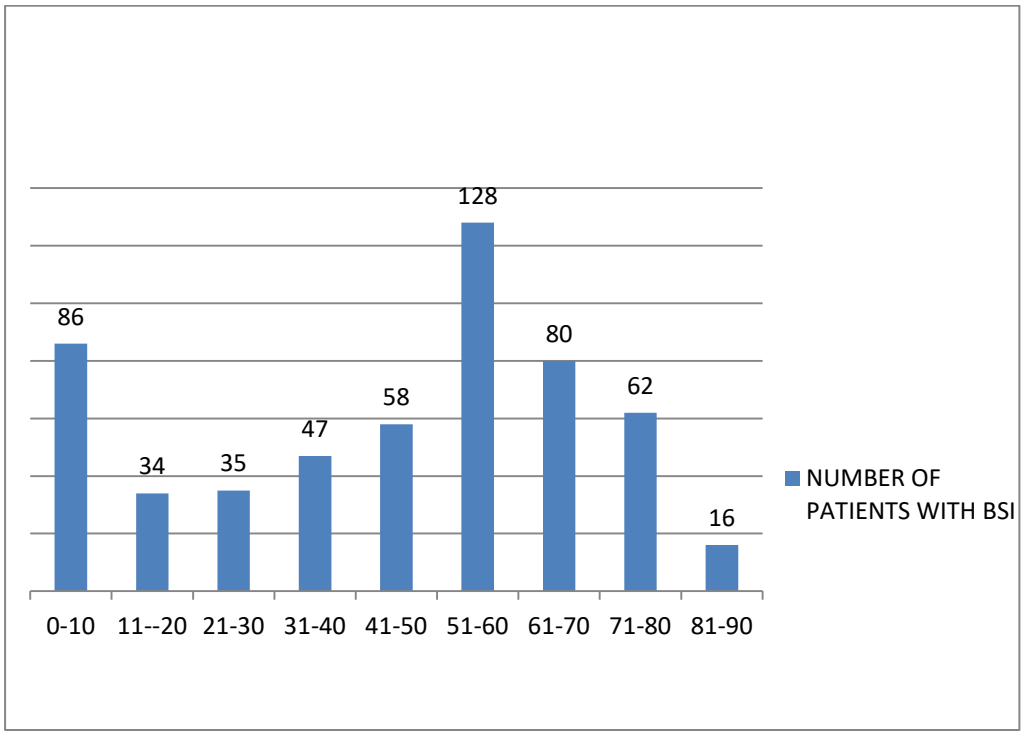
All the results are depicted in the tables and graphs that follow:

Fig 1: Gender wise distribution of the patients with BSI (n=546)



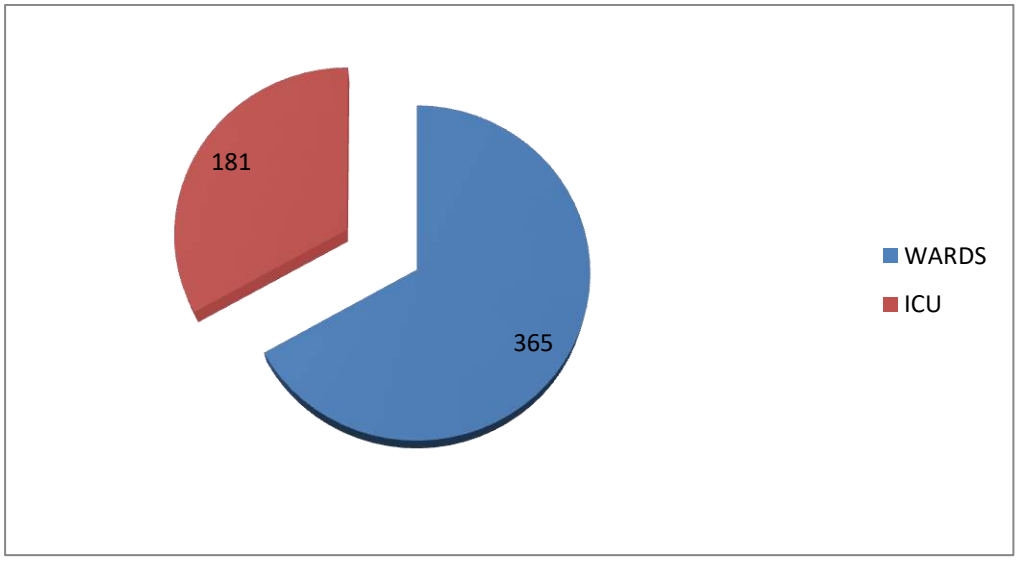
Majority of patients with BSI were Males (66.7%) as compared to Females (33.3%).

Fig 2: Age wise distribution of the patients with BSI (n=546)



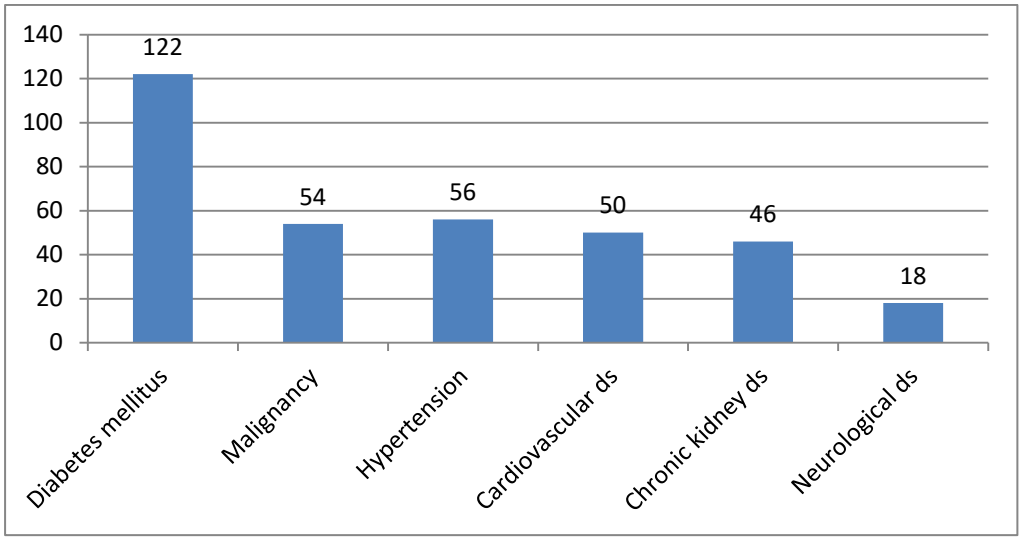
Majority of patients with BSI were in the age group of 51-60 years (23.4%), followed by patients aged 0-10 years (15.7%). The mean age of the patients enrolled was 45±2 years.

Fig 3: Area wise Distribution of patients with BSI (n=546)



Majority of patients with BSI were from Wards (66.8%) as compared to ICUs (33.2%).

Fig 4: Comorbidities in the patients with BSI (n=546)

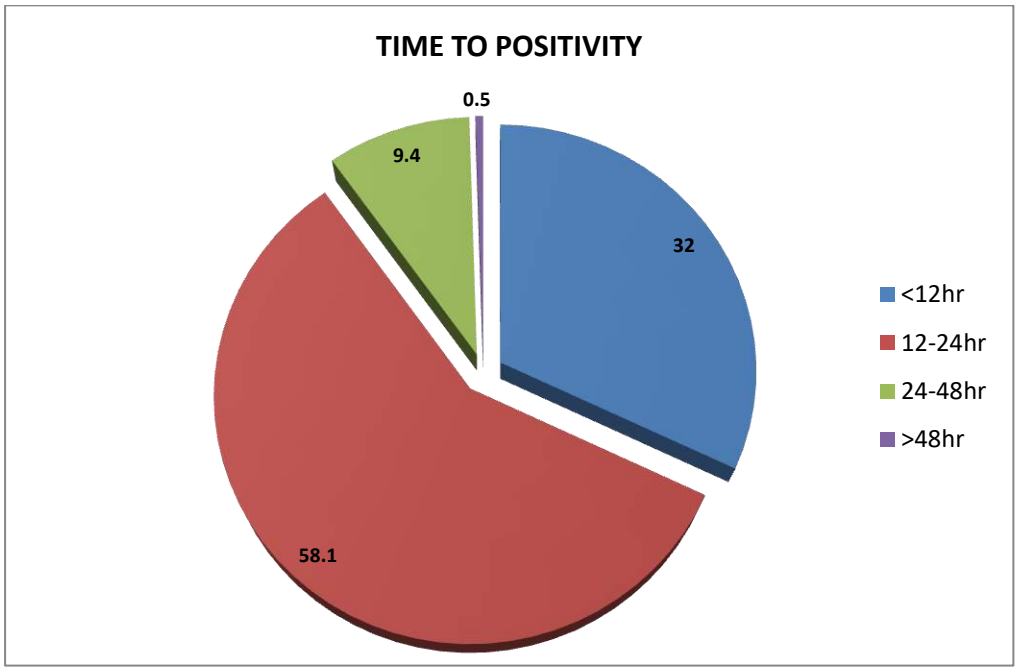


Most common comorbidity present among the patients with BSI was Diabetes mellitus (22.3%) followed by Hypertension (10.3%).

Table 7: Time to positivity of Gram negative bacterial isolates from blood samples (n=546)

TIME TO POSITIVITY	NUMBER OF ISOLATES
<12hr	317
12-24hr	174
24-48hr	52
>48hr	3
TOTAL	546

Fig 5: Graphical representation of time to positivity of Gram negative bacterial isolates from blood samples (n=546)



Maximum number of the isolates 317(58.1%) were obtained within 12-24 hours while 174(32%) of the isolates were grown in less than 12 hours.

Table 8: Distribution of Gram negative bacterial isolates from blood samples (n=546)

Distribution of Gram negative isolates	Number(%)
Ecoli	**174(31.8)**
Klebsiella sp.	**170(31.2)**
Klebsiella pneumoniae	164(30)
Klebsiella oxytoca	4(0.8)
Klebsiella ozanae	2(0.4)
Acinetobacter sp.	**88(16.1)**
Acinetobacter baumannii	85(15.6)
Acinetobacter lwoffii	3(0.5)
Salmonella sp*.*	**39(6.9)**
Salmonella typhi	36(6.4)
Salmonella paratyphi A	3(0.5)
Pseudomonas sp.	**34(6.3)**
Pseudomonas aeruginosa	32(5.9)
Pseudomonas stutzeri	2(0.4)
Enterobacter cloacae complex	**19(3.5)**
Citrobacter koseri	**6(1.2)**
Achromobacter xylosans	**4(0.7)**
Stenotrophomonas maltophilia	**4(0.7)**
Proteus mirabilis	**3(0.6)**
Sphingomonas paucimobilis	**2(0.4)**
Burkholderia cepacia	**1(0.2)**
Serratia marscenses	**1(0.2)**
Elizabethkingia meningoseptica	**1(0.2)**
TOTAL	**546**

Among all the Gram negative isolates *E.coli* (31.8%) was the most common organism isolated followed by *Klebsiella spp.* (31.2%),

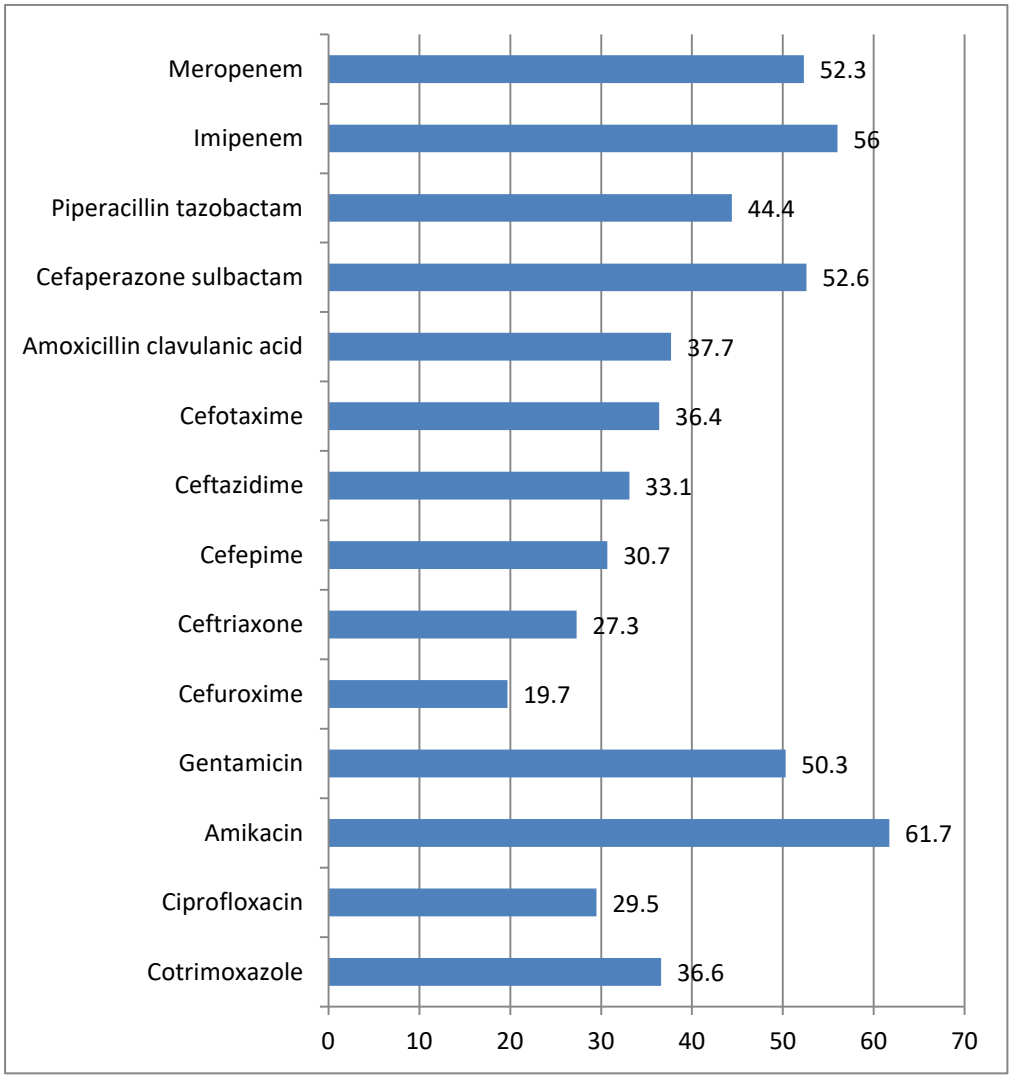
Acinetobacter spp.(16.1%), *Salmonella spp.* (6.9%) and *Pseudomonas spp.* (6.3%).

Table 9: Antibiotic susceptibility pattern of Gram negative isolates (n=546)

Antimicrobial agents	Sensitivity (%)
Cotrimoxazole	36.6
Ciprofloxacin	29.5
Amikacin	61.7
Gentamicin	50.3
Cefuroxime	19.7
Ceftriaxone	27.3
Cefepime	30.7
Ceftazidime	33.1
Cefotaxime	36.4
Amoxicillin clavulanic acid	37.7
Cefaperazonesulbactam	52.6
Piperacillintazobactam	44.4
Imipenem	56
Meropenem	52.3

Among the Gram negative isolates maximum sensitivity was seen to amikacin (61.7%) followed by imipenem (56%), cefaperazone sulbactam (52.6%), meropenem (52.3%) and gentamicin (50.3%).

Fig 6: Graphical representation of antibiotic susceptibility pattern of Gram negative bacterial isolates(n=546)



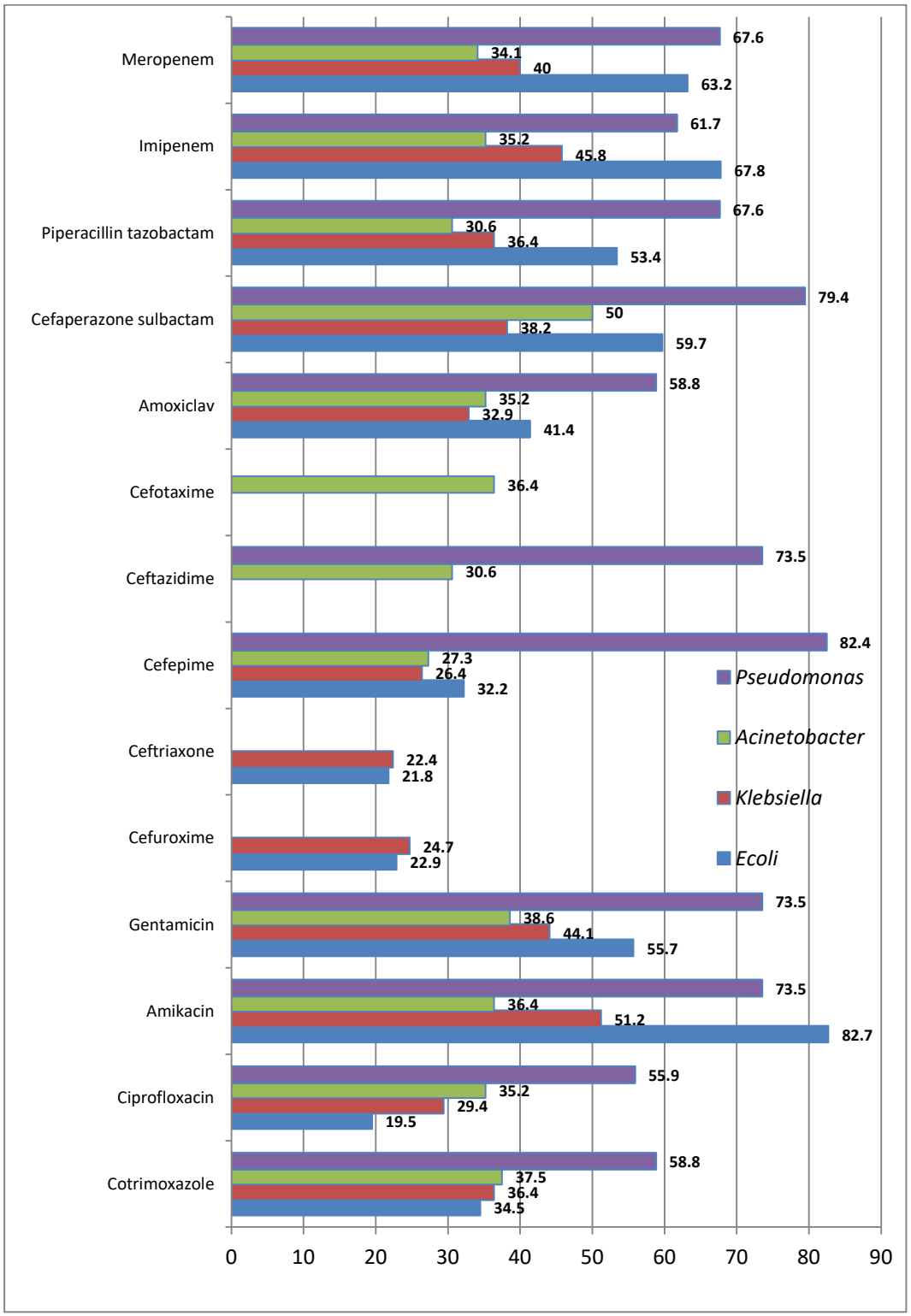
The Gram negative isolates showed high resistance to cephalosporins (70%), ciprofloxacin (70%) followed by amoxicillin clavulanic acid (62.3%) and cotrimoxazole (60.6%).

Table 10: Antibiotic susceptibility pattern of the predominant Gram negative bacterial isolates (n=546)

ANTIBIOTICS	ORGANISM				
	E.coli spp. (n=174)(%)	***Klebsiella spp. (n=170)(%)***	***Acinetobacter spp. (n=88) (%)***	***Pseudomonas spp. (n=34) (%)***	***Salmonella spp. (n=39) (%)***
Cotrimoxazole	60(34.5%)	62(36.4%)	33(37.5%)	20(58.8%)	39(100%)
Ciprofloxacin	34(9.5%)	50(29.4%)	31(35.2%)	19(55.9%)	6(15.4%)
Amikacin	144(82.7%)	87(51.2%)	32(36.4%)	25(73.5%)	-
Gentamicin	97(55.7%)	75(44.1%)	34(38.6%)	25(73.5%)	-
Cefuroxime	40(22.9%)	42(24.7%)	-	-	3(7.7%)
Ceftriaxone	38(21.8%)	38(22.4%)	-	-	38(97.4%)
Cefepime	56(32.2%)	45(26.4%)	24(27.3%)	28(82.4%)	-
Ceftazidime	-	-	27(30.6%)	25(73.5%)	-
Cefotaxime	-	-	32(36.4%)	-	-
Amoxicillin clavulanic acid	72(41.4%)	56(32.9%)	31(35.2%)	20(58.8%)	-
Cefaperazonesulbactam	104(59.7%)	65(38.2%)	44(50%)	27(79.4%)	-
Piperacillintazobactam	93(53.4%)	62(36.4%)	27(30.6%)	23(67.6%)	-
Imipenem	118(67.8%)	70(45.8%)	31(35.2%)	21(61.7%)	-
Meropenem	110(63.2%)	68(40%)	30(34.1%)	23(67.6%)	-

All the 39 (100%) isolates of *Salmonella spp.* were tested susceptible to ofloxacin, azithromycin, cefixime, chloramphenicol and 36(92.3%) to ampicillin.

Fig 7: Graphical representation of antibiotic susceptibility pattern of the predominant Gram negative bacterial isolates (n=546)

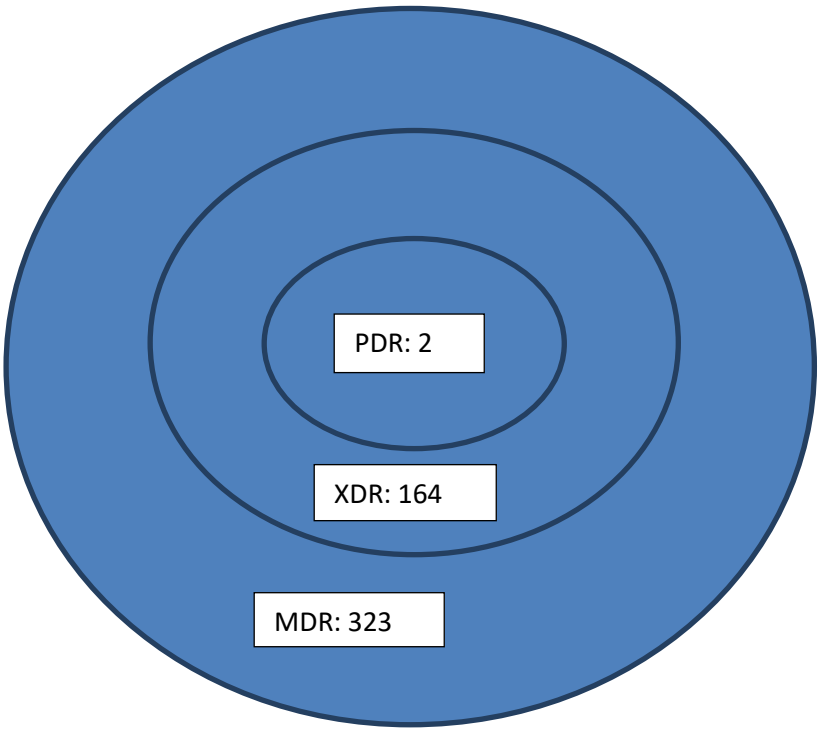


Out of all, 82.7% isolates of *Escherichia coli* were susceptible to amikacin followed by carbapenems (63-68%), while low susceptibility

was seen to cephalosporins(44.6%), amoxicillin clavulanic acid(41.4%)andciprofloxaxin (9.5%).Like *E.coli, Klebsiella spp.* isolates also showed good susceptibility to amikacin (51.2%) and carbapenems (40-45%) whereas low susceptibility was seen to cephalosporins (20-25%). *Klebsiella spp.* isolates had higher resistance to most of these antibiotics as compared to *E.coli* except ciprofloxacin (29.4%). *Acinetobacter spp.* showed relatively low susceptibility to aminoglycosides (37%) as compared to the other Gram negative bacteria and better susceptibility was observed to cefotaxime (36.4%) as compared to other cephalosporins (27-30%).Moderate susceptibility was seen to ciprofloxacin (35.2%) and cotrimoxazole(37.5%). Though, *Pseudomonas spp.*was seen susceptible(55-82%) to most of the antibiotics.

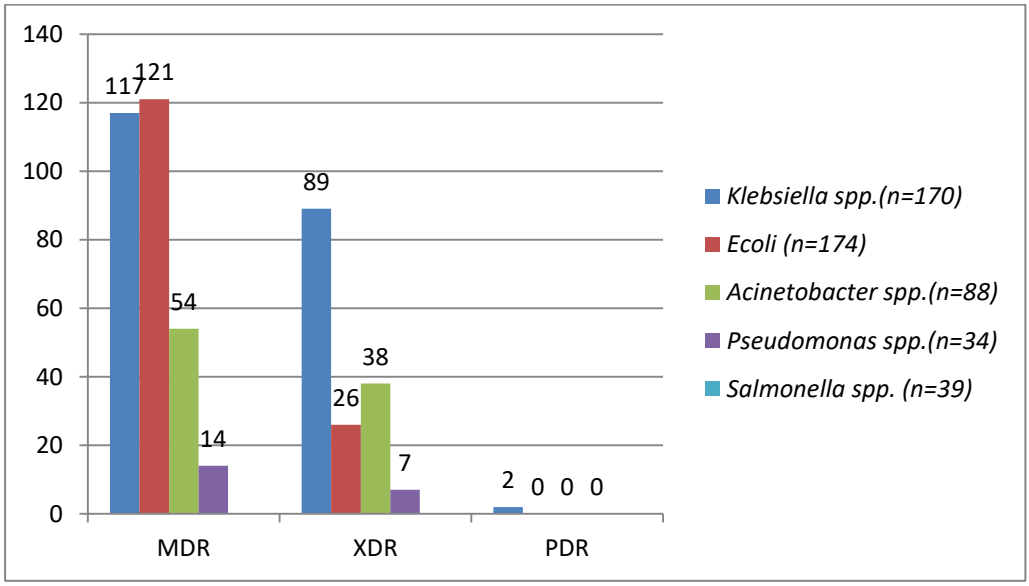
Further characterization of Gram negative isolates into MDR/XDR/PDR was done.

Fig 8: Characterization of Gram Negative Isolates (n=546)



Out of 546 isolates, 223(40.8%) isolates were observed susceptible to most of the classes of the antibiotics. Rest of the isolates showed resistance for many classes of antibiotics, were characterized as MDR (59.2%), XDR (30%) and PDR (0.4%).

Fig 9: Characterization of common Gram negative isolates (n=546)



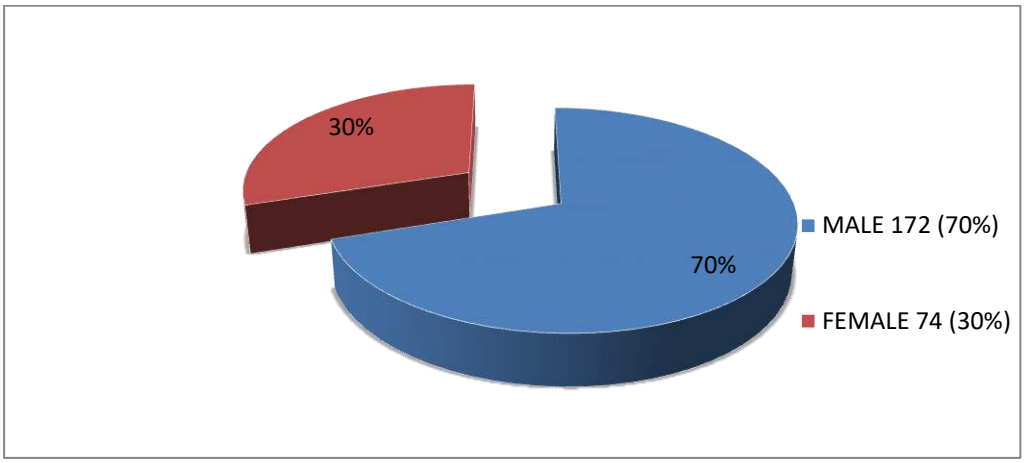
Maximum MDR isolates were *E.coli* (69.5%) followed by *Klebsiella spp.* (68.8%), *Acinetobacter spp.* (61.4%) and *Pseudomonas spp* (41.2%). While maximum XDR isolates were *Klebsiella spp.*(52.4%) followed by *Acinetobacter spp.* (43.2%), *Pseudomonas spp.* (20.6%) and *E.coli*(14.9%).However, all the PDR isolates were *Klebsiella spp.* 2(1.2%). Multidrug resistance was not observed in the *Salmonella spp.* isolates.

CARBAPENEM RESISTANCE

Imipenem/Meropenem resistance was used as an indication for carbapenem resistance.

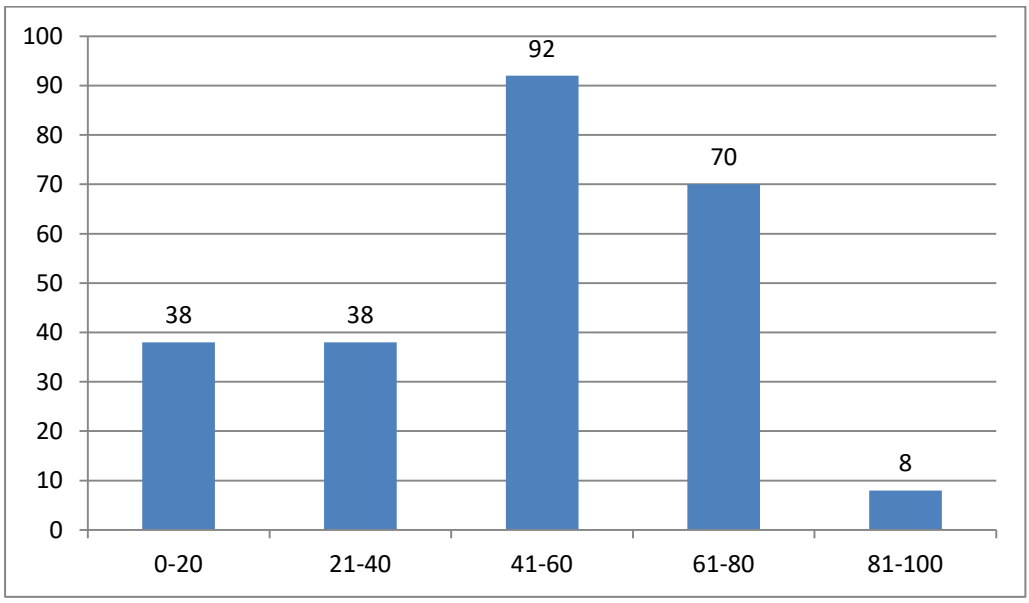
Out of the total 546Gram negative isolates, 507 isolates (39 *Salmonella spp.* excluded) were tested for carbapenem susceptibility. Out of these, 246 (48.5%) were found carbapenem resistant.

Fig 10: Gender wise distributionof patients with BSI due to carbapenem resistant isolates(n=246)



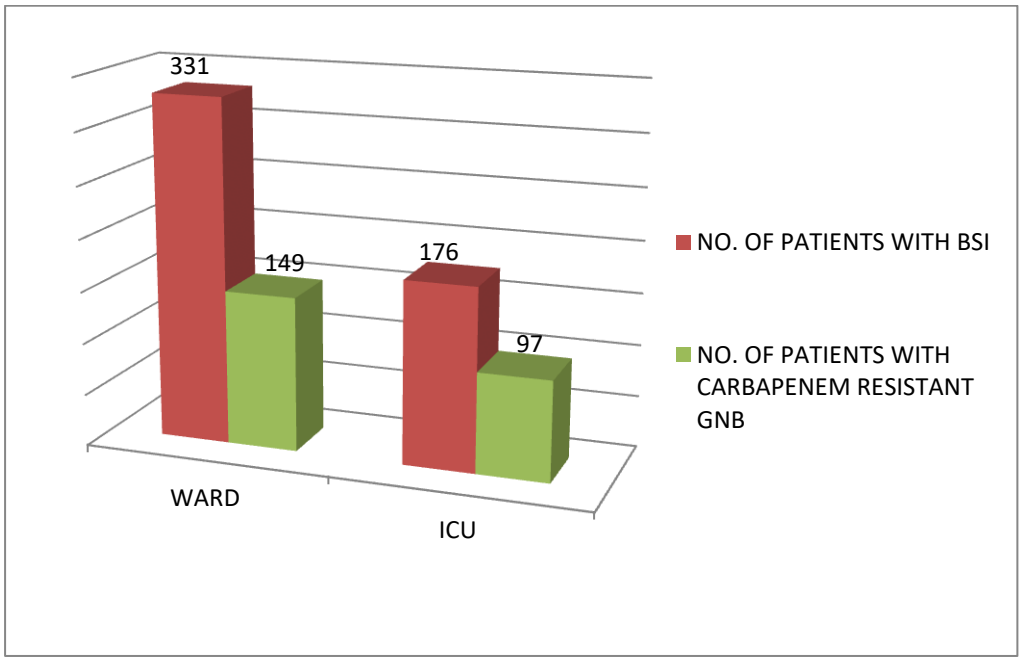
BSI due carbapenem resistant Gram negative isolateswas observed more among male patients(70%).

Fig 11: Age wise distribution of patients with BSI due to carbapenem resistant isolates (n=246)



The median age of patients with infections due to carbapenem resistant isolates was 48±2 years and maximum samples 92(37.3%) were obtained from age group of41-60 years.

Fig 12: Area wise distribution of patients with BSI due to carbapenem resistant Gram negative isolates (n=246)



Patients admitted in ICUs (55.1%) had more infections due to carbapenem resistant Gram negative bacteria as compared to the patients admitted in the wards (44%).

Table 11: Distribution of patients with BSI due to carbapenem resistant isolates in various ICUs and wards (n=246)

ICU	Total number of patients with BSI (n=507)	Number of patients with carbapenem resistant(CR) isolates (n=246)	Percentage
MICU	102	63	61.8%
SICU	46	24	52.2%
PICU	28	10	3.6%
Ward			
MW	273	122	44.7
SW	41	21	51.2
PW	17	6	35.3

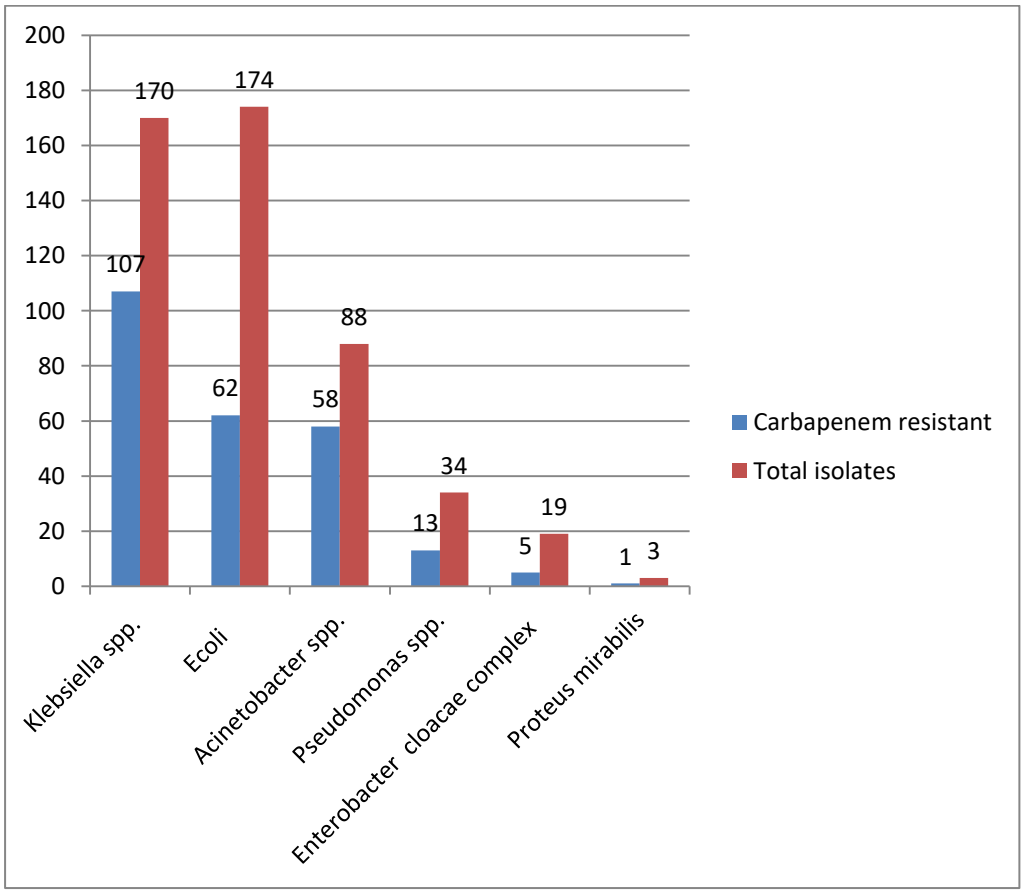
Maximum number of patients with BSI due to carbapenem resistant isolates were seen in medical ICUs (61.8%) followed by surgery ICUs (52.2%) and surgery ward.

Table 12: Distribution of patients with BSI due to predominant carbapenem resistant isolates in various ICUs and wards (n=246)

ICU	*Klebsiellaspp.*	*E.coli*	*Acinetobacter spp.*	*Pseudomonas spp.*	*Enterobacter cloacae complex*	*Proteus mirabilis*
MICU	25/32(78.1%)	15/35(42.8%)	20/26(76.9%)	3/5(60%)	-	
SICU	13/19(68.4%)	3/8(37.5%)	6/9(66.7%)	1/6(16.7%)	1/4(25%)	
PICU	3/12(25%)	2/5(40%)	1/4(25%)	2/2(100%)	2/4(50%)	
Ward						
MW	55/90(61.1%)	32/104(30.8%)	26/40(65%)	6/16(37.5%)	2/9(22.2%)	1/2(50%)
SW	9/12(75%)	7/17(41.2%)	4/5(80%)	1/3(33.3%)	0/1(0%)	-
PW	2/5(40%)	3/5(60%)	1/4(25%)	0/2(0%)	0/1(0%)	-

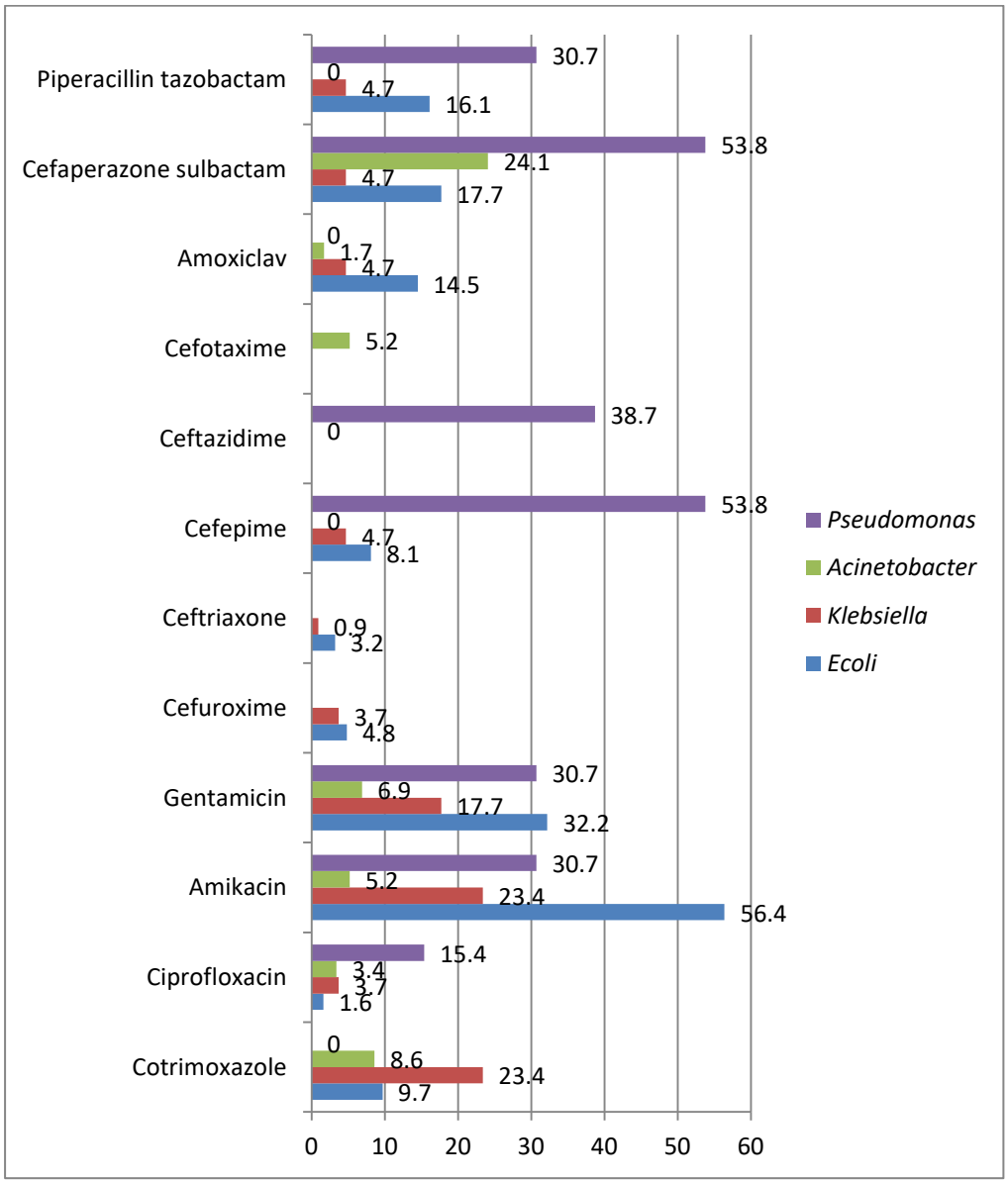
In the MICUs maximum number of infections due to carbapenem resistant isolates were due to *Klebsiella spp.* 25(78.1%) followed by *Acinetobacter spp.*20(76.9%) and *Pseudomonas spp*. 3(60%).In the SICUs maximum number of infections due to carbapenem resistant isolates were due to *Klebsiella spp.* 13(68.4%) followed by *Acinetobacter spp.*6(66.7%) and *Ecoli* 3(37.5%). In the PICUs 2(100%) of *Pseudomonas spp.* were carbapenem resistant followed by *Enterobacter cloacae complex*(50%).In the Medical ward maximum number of infections due to carbapenem resistant isolates were due to *Acinetobacter spp.* 26(65%) followed by *Klebsiella spp.* 55(61.1%) and *Pseudomonas spp*. 6(37.5%). In the Surgical ward maximum number of infections due to carbapenem resistant isolates were due to *Acinetobacter spp.*4(80%) followed by *Klebsiella spp.*9(75%) and *E.coli* 7(41.2%). In the Paediatric ward 3(60%) of *Pseudomonas spp.* were carbapenem resistant followed by *Klebsiella spp. 2*(40%).

Fig 13: Percentage of various carbapenem resistant isolates (n=246)



Maximum carbapenem resistance was observed among *Acinetobacter spp.* (65.9%) followed by *Klebsiella spp.*(62.9%); *Pseudomonas spp.* (38.2%); *E.coli*(35.6%);*Proteus mirabilis* (33.3%) and *Enterobacter cloacae complex*(26.3%).

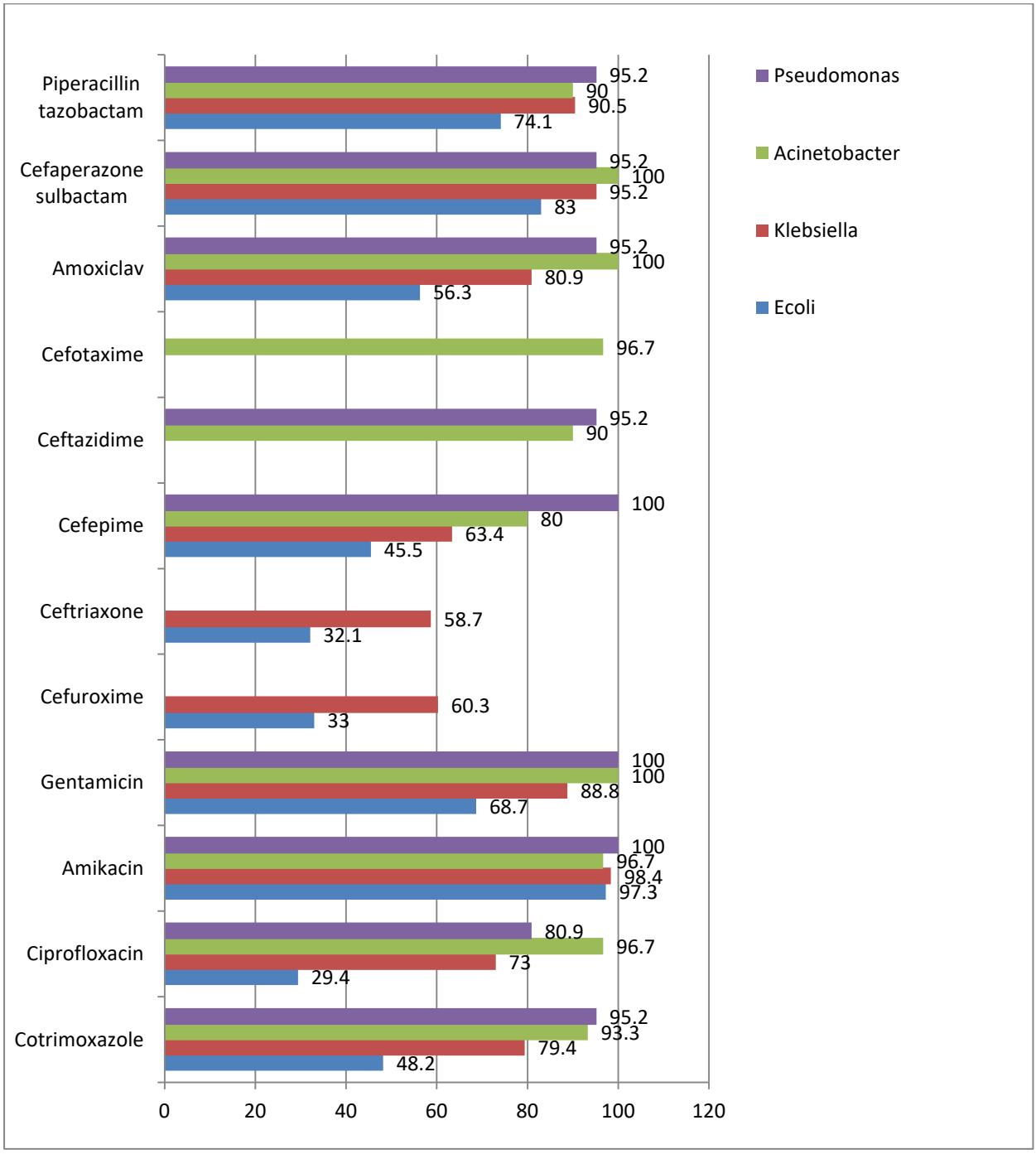
Fig 14: Antibiotic susceptibility profile of common carbapenem resistant isolates (n=246)



Carbapenem resistant *Klebsiella spp.* and *Acinetobacter spp.* showed very high resistance to other classes of antibiotics. Carbapenem resistant *E.coli* was relatively susceptible to amikacin (56.4%), while very low susceptibility was seen to cephalosporins (<5%) and ciprofloxacin (<5%).

Carbapenem resistant *Pseudomonas spp.* showed good susceptibility to cefaperazone sulbactam and cefepime. (53.8%) as compared to other organisms.

Fig 15: Antibiotic susceptibility profile of common carbapenem sensitive isolates(n=261)



Carbapenem sensitive Gram negative bacteria showed better antimicrobial susceptibility to the other classes of antibiotics as compared to carbapenem resistant Gram negative bacteria. More than 80% isolates of carbapenem sensitive Enterobacteriaceae (*E.coli and Klebsiella spp.)* were susceptible to aminogylcosides and combination

drugs (80%), while low susceptibility was seen to cephalosporins(<60%) and ciprofloxaxin (51.2%). Carbapenem sensitive *E.coli* showed higher resistance to most of the antibiotics than other Gram negative isolates. Carbapenem sensitive *Acinetobacter spp*. (80-100%) *and Pseudomonas* spp. (95-100%) have shown good susceptibility to most of the antibiotics

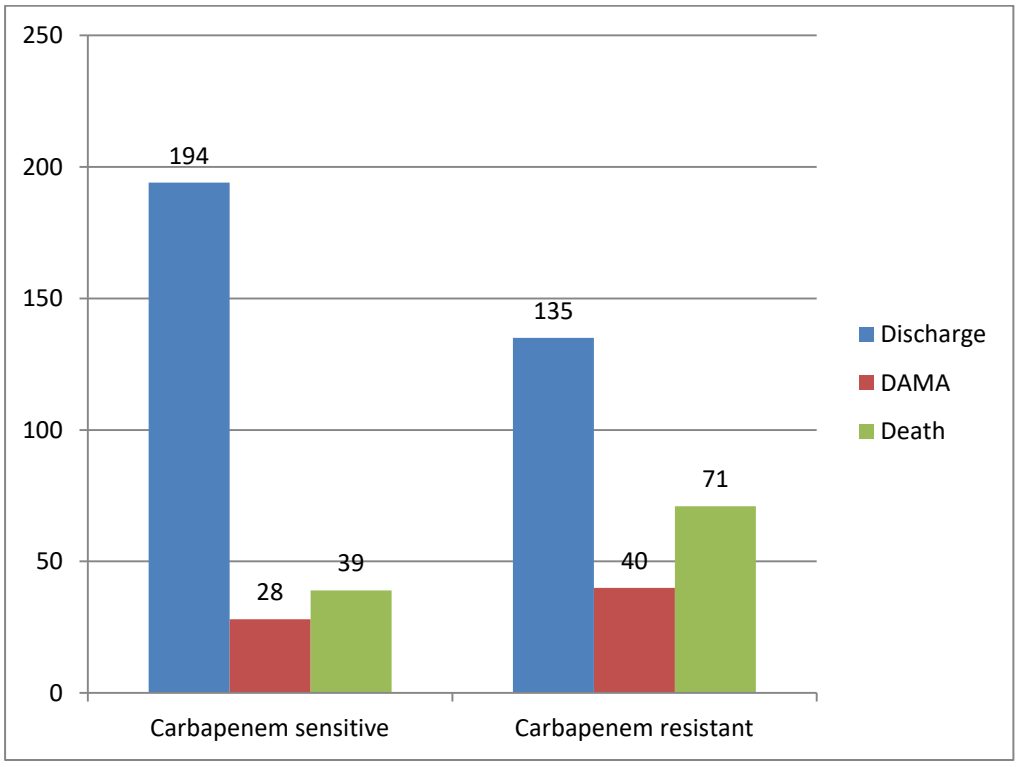
Table 13: Comparison of antibiotic susceptibility profile of common carbapenem sensitive (n=261) and resistant (n=246) isolates

	Ecoli(n=174)			*Klebsiella*(n=170)		
	CARBAPENEM SENSITIVE(n=112)	CARBAPENEM RESISTANT(n=62)	P-value	CARBAPENEM SENSITIVE(n=63)	CARBAPENEM RESISTANT(n=107)	P-value
Cotrimoxazole	54(48.2%)	6(9.7%)	0.001	50(79.4%)	12(11.2%)	0.001
Ciprofloxacin	33(29.4%)	1(1.6%)	0.001	46(73%)	4(3.7%)	0.001
Amoxiclav	63(56.3%)	9(14.5%)	0.001	51(80.9%)	5(4.7%)	0.001
Amikacin	109(97.3%)	35(56.4%)	0.001	62(98.4%)	25(23.4%)	0.001
Gentamicin	77(68.7%)	20(32.2%)	0.001	56(88.8%)	19(17.7%)	0.001
Cefuroxime	37(33%)	3(4.8%)	0.001	38(60.3%)	4(3.7%)	0.001
Ceftriaxone	36(32.1%)	2(3.2%)	0.001	37(58.7%)	1(0.9%)	0.001
Cefepime	51(45.5%)	5(8.1%)	0.001	40(63.4%)	5(4.7%)	0.001
Cefaperazonesulbactam	93(83%)	11(17.7%)	0.001	60(95.2%)	5(4.7%)	0.001
Piperacillintazobactam	83(74.1%)	10(16.1%)	0.001	57(90.5%)	5(4.7%)	0.001
	Acinetobacter(n=88)			*Pseudomonas*(n=34)		
	CARBAPENEM SENSITIVE(n=30)	CARBAPENEM RESISTANT(n=58	P-value	CARBAPENEM SENSITIVE(n=2	CARBAPENEM RESISTANT(n=13	P-value

		)		1)	)	
Cotrimoxazole	28(93.3%)	5(8.6%)	0.001	20(95.2%)	0	0.001
Ciprofloxacin	29(96.7%)	2(3.4%)	0.001	17(80.9%)	2(15.4%)	0.001
Amoxiclav	30(100%)	1(1.7%)	0.001	20(95.2%)	0	0.001
Amikacin	29(96.7%)	3(5.2%)	0.001	21(100%)	4(30.7%)	0.001
Gentamicin	30(100%)	4(6.9%)	0.001	21(100%)	4(30.7%)	0.001
Cefepime	24(80%)	0	0.001	21(100%)	7(53.8%)	0.001
Ceftazidime	27(90%)	0	0.001	20(95.2%)	5(38.7%)	0.001
Cefotaxime	29(96.7%)	3(5.2%)	0.001			
Cefaperazonesulbactam	30(100%)	14(24.1%)	0.001	20(95.2%)	7(53.8%)	0.001
Piperacillintazobactam	27(90%)	0	0.001	20(95.2%)	4(30.7%)	0.001

Significant association was seen between carbapenem resistant isolates and resistance to other classes of antibiotics (p-value ≤0.05).

Fig 16: Outcome of patients with BSI due to carbapenem resistant and carbapenem sensitive Gram negative bacteria (n=507)



DAMA (7.9%) and Death (14%) was observed more in patients harbouring carbapenem resistant isolates than in patients with carbapenem sensitive isolates. 38.3% patients with carbapenem sensitive isolates and 26.6% patients with carbapenem resistant isolates improved and were discharged.

Table 14: Comparison of clinical characteristics of patients with Carbapenem sensitive and resistant isolates

Characteristic N	Sensitive 261	Resistant 246	P-value
AGE			
0-20	52	38	0.187
21-40	36	38	0.59
41-60	93	92	0.67
61-80	72	70	0.87

81-100	8	8	0.904
GENDER			
Female	94	74	0.155
Male	167	172	0.155
AREA DISTRIBUTION			
WARD	182	148	0.023
ICU	79	98	0.023
COMORBIDITIES			
Diabetes mellitus	69	51	0.13
Malignancy	30	24	0.52
Hypertension	21	33	0.050
Cardiovascular ds	19	31	0.044
Chronic kidney ds	30	13	0.012
Neurological ds	7	10	0.387
RISK FACTORS			
ICU stay(>7days)	50	47	0.988
OUTCOME			
Discharged	194	135	<0.00001
DAMA	28	40	0.067
Death	39	71	0.0001

A significant association of carbapenem resistant infections with patient stay in ICU and comorbidities (Hypertension, cardiovascular ds and chronic kidney ds) was observed. Significant high mortality was observed among patients with BSI due to carbapenem resistant bacteria (p-value ≤0.05).

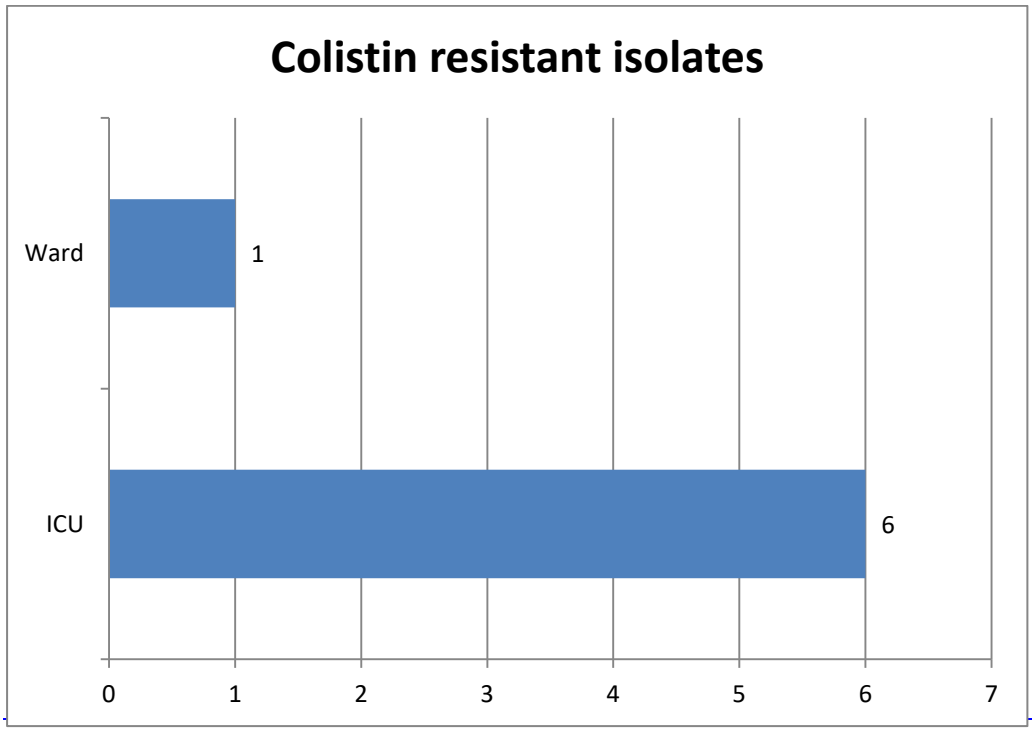
COLISTIN SUSCEPTIBILITY

Isolates resistant to carbapenems were further tested by BMD method for determination of colistin MIC.As *Proteus mirabilis*is intrinsically resistant to colistin therefore it was not tested by BMD. Out of the

remaining 245 carbapenem resistant isolates, only 7 (2.9%) isolates were found resistant to colistin by BMD.

Mean age of the patients from which colistin resistant isolates were obtained was58±1years. Median length of stay in the hospital was 14 days.

Fig 17: Area-wise distribution of patients with colistin resistant isolates (n=7)



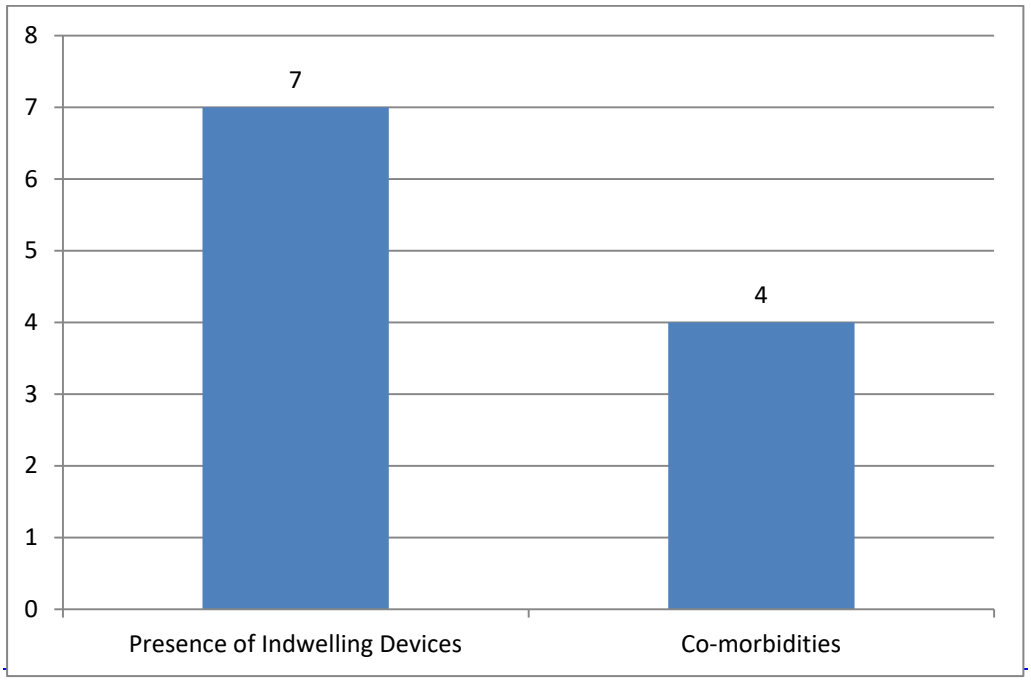
Out of the total 7 colistin resistant isolates, 6(85.7%) were isolated from ICU samples, while only 1 isolate (14.3%) was from ward.

Table 15: Distribution of patients with colistin resistant isolates according to length of hospital stay (n=7)

Length of Hospital Stay(days)	Patients with colistin resistant isolates		Percentage%
	ICU(n=6)	WARD(n=1)	
1-7	1	1	28.6
7-14	2	0	28.6
>14	3	0	42.8

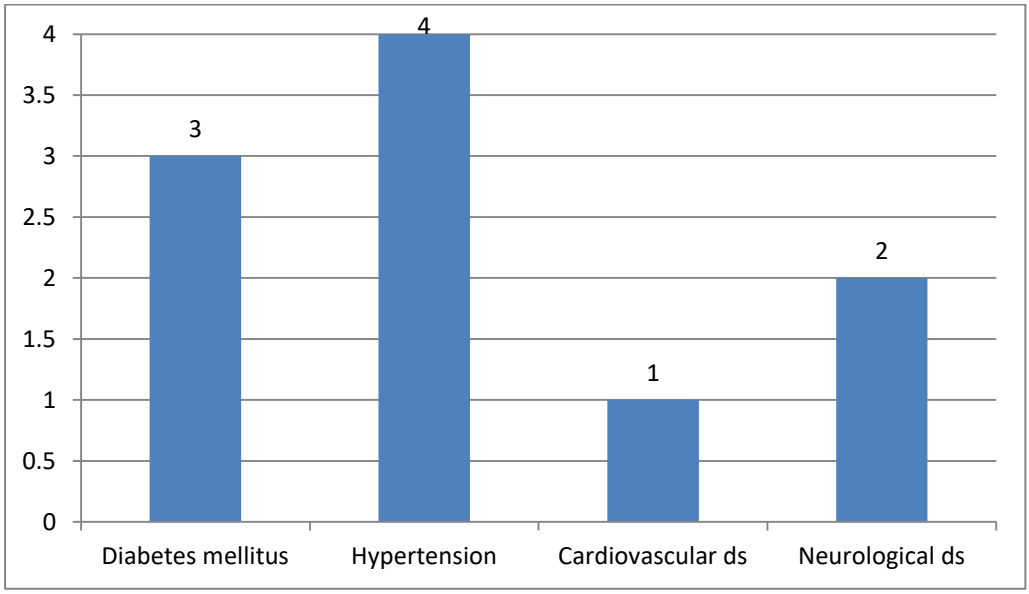
Colistin resistant isolates were majorly 5 (71.4%)obtained from patients with prolonged hospital stay(>1 week)while 2 (28.6%) patients had hospital stay of <7 days.

Fig 18: Risk factors in patients with colistin resistant isolates (n=7)



Further it was noted that the Indwelling devices (ET tube, catheters, tracheostomies etc)and underlying comorbidities were present in the patients harbouring colistin resistant isolates.

Fig 19: Comorbidities in patients with colistin resistant isolates (n=4)



Comorbidies present were Diabetes mellitus in 3, Hypertension in 4, Neurological ds in 2 patients and CVS ds in 1.

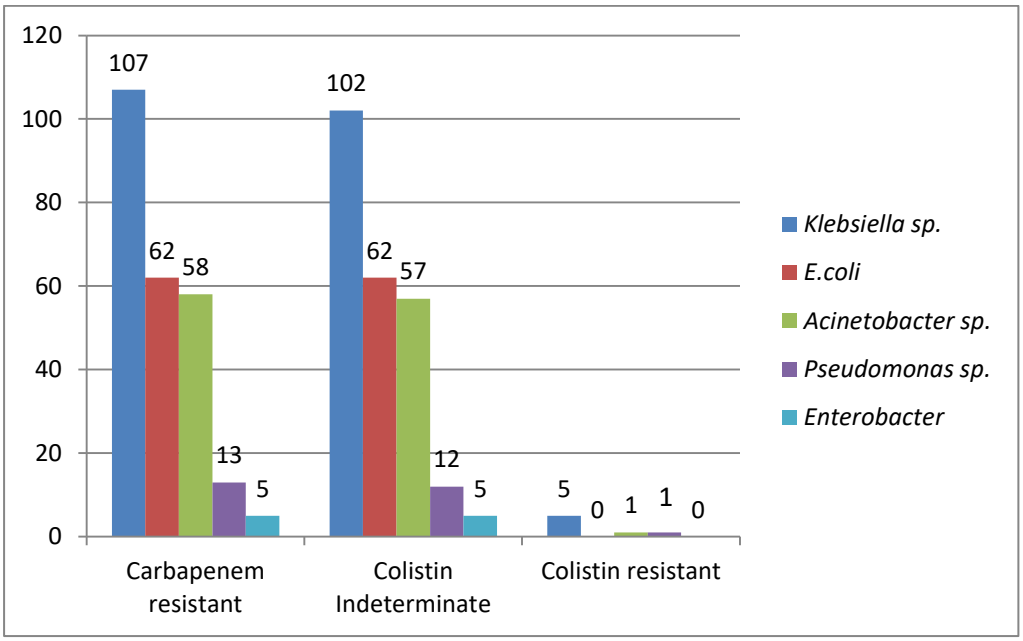
Table 16: Colistin susceptibility profile of carbapenem resistant isolates by Broth microdilution method (n=245)

Organism	Number of isolates n(%)	Colistin intermediate isolates(MIC≤2ug/ml) n(%)	Colistin resistant isolates (MIC≥4ug/ml) n(%)
Klebsiella spp.	107(43.7%)	102(95.3%)	5(4.7%)
Ecoli	62(25.3%)	62(100%)	0 (0%)
Acinetobacter spp.	58 (23.7%)	57 (98.3%)	1(1.7%)
Pseudomonas spp.	13(5.3%)	12(92.3%)	1(7.7%)
Enterobactercloacae complex	5(2%)	5(100%)	0 (0%)
Total	245(100%)	238(97.1%)	7 (2.9%)

Out of all carbapenem resistant Gram negative isolates only 2.9% were found resistant to colistin by BMD test. Among the colistin resistant isolates, mostly were *Klebsiella spp*. (71.4%) followed by

Acinetobacterspp. (14.3%) &*Pseudomonas spp*. (14.3%) Colistin resistance was not seen in the other carbapenem resistant Gram negative isolates.

Fig 20: Graphical representation of colistin susceptibility profile of carbapenem resistant isolates (n=245)



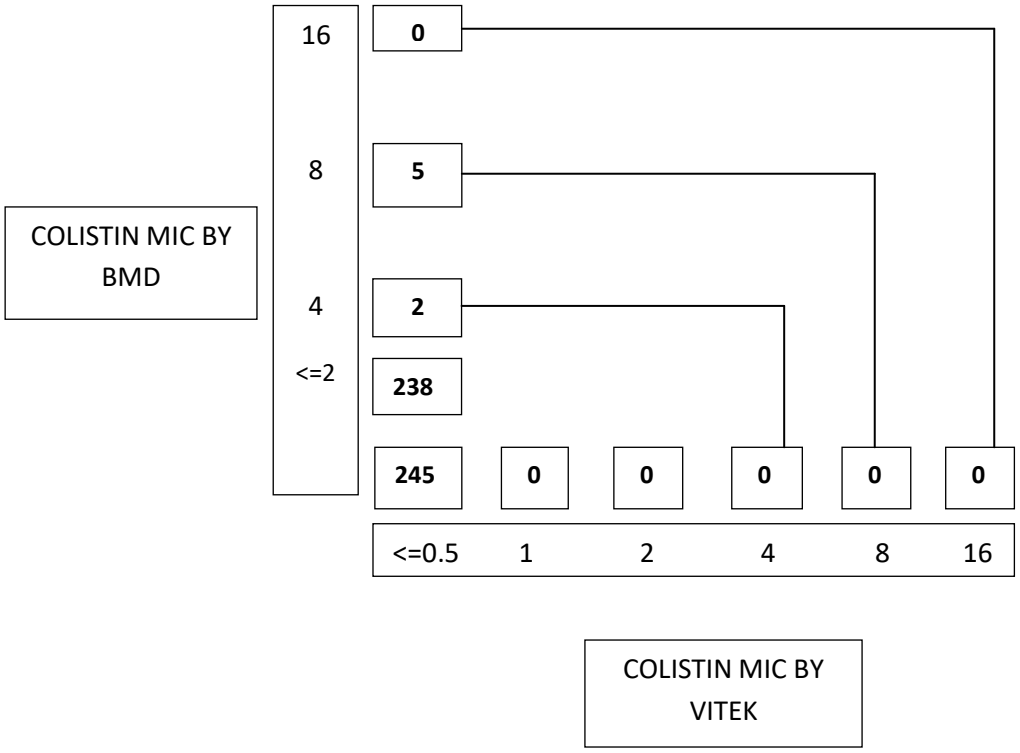
Colistin resistance was seen in *Klebsiella spp*., *Acinetobacterspp.* & *Pseudomonas spp.*

Table 17: Distribution of carbapenem resistant Gram negative isolates with colistin MIC (n=245)

Organism	Number of isolates with colistin MIC (µg/ml)			
	MICROBROTH DILUTION			VITEK
	MIC≤2 (I)	≥4 to≤8 (R)	>8 to<=16 (R)	≤0.5 (I)
Ecoli(n=62)	62(100%)	0	0	62(100%)
Klebsiella spp. (n=107)	102(95.3%)	2(1.9%)	3(2.8%)	107(100%)
Acinetobacter spp.(n=58)	57(98.3%)	0	1(1.7%)	58(100%)
Pseudomonas spp. (n=13)	12(92.3%)	0	1(7.7%)	13(100%)
Enterobacter cloacae complex spp. (n=5)	5(100%)	0	0	5(100%)
TOTAL (n=245)	238(97.1%)	2(0.8%)	5(2.1%)	245(100%)

Among all the cabapenem resistant isolates, 7(2.9%) were found resistant (MIC ≥4µg/ml) to colistin by BMD method while all these isolates were found intermediate sensitive to colistin by VITEK-2 system(MIC ≤0.5 µg/ml).

Fig 21: Comparison of colistin MIC by BMD method and VITEK-2 system



Among the colistin resistant isolates MIC of ≥4µg/ml was observed in *Klebsiella spp*. 2(1.9%) isolates and ≥8µg/ml in 3(2.8%) *Klebsiella spp*., 1(1.7%) *Acinetobacter spp*. *and* 1(7.7%) *Pseudomonas spp*. isolates.

Table 18: MIC of various other antibiotics for the colistin resistant isolates (n=7)

S.NO	ISOLATE	COT	CIP	LEVO	AK	GEN	CTR	CPM	CFM	CAZ	CFSB	PT	AMC	IMI	MER
1	*Pseudomonas spp.*	≥320 (R)	≥4 (R)	>=8 (R)	≥64 (R)	≥16 (R)	-	8 (S)	-	≥64 (R)	≥64 (R)	≥64 (R)	≥32 (R)	≥16 (R)	8 (I)
2	*K. pneumoniae*	≥320 (R)	≥4 (R)	-	≥64 (R)	<=1 (S)	≥64 (R)	≥64 (R)	≥64 (R)	-	≥64 (R)	≥64 (R)	≥32 (R)	2 (I)	≥16 (R)
3	*K. pneumoniae*	≥320 (R)	≥4 (R)	-	≥64 (R)	≥16 (R)	≥64 (R)	≥64 (R)	≥64 (R)	-	≥64 (R)	≥64 (R)	≥32 (R)	≥16 (R)	≥16 (R)
4	*K. pneumoniae*	≥320 (R)	≥4 (R)	-	≥64 (R)	≥16 (R)	≥64 (R)	≥64 (R)	≥64 (R)	-	≥64 (R)	≥64 (R)	≥32 (R)	≥16 (R)	≥16 (R)
5	*K. pneumoniae*	≥320 (R)	≥4 (R)	-	32 (I)	<=1 (S)	≥64 (R)	≥64 (R)	≥64 (R)	-	≥64 (R)	≥64 (R)	≥32 (R)	2 (I)	≥16 (R)
6	*K. pneumoniae*	≥320 (R)	≥4 (R)	-	≤2 (S)	≥16 (R)	≥64 (R)	8 (S)	≥64 (R)	-	≥64 (R)	≥64 (R)	≥32 (R)	2 (I)	≥16 (R)
7	*A. baumannii*	≥320 (R)	<=0.25 (S)	0.25 (S)	≥64 (R)	≥16 (R)	-	≥64 (R)	-	≥64 (R)	16 (S)	≥128 (R)	≥32 (R)	≥16 (R)	≥16 (R)

COT- cotrimoxazole, AK-amikacin, GEN-gentamicin, AMC- amoxicillin clavulanic acid, CTR- ceftriaxone, CIP-ciprofloxacin, CFSB-cefaperazonesulbactam, PT-piperacillintazobactam, CFM-cefipime,CAZ-ceftazidime, CPM-cefepime, MER-meropenem, IMI-imipenem, LEVO-levofloxacin.

Table 19: Comparison of antibiotic susceptibility profile of colistin intermediate and resistant isolates (n=245)

Antibiotics	**Colistin intermediate (238)**	**Colistin resistant (7)**	**p-value**
Cotrimoxazole	26/238(10.9%)	0/7	0.77
Ciprofloxacin	9/238(3.8%)	1/7(14.3%)	0.16
Amikacin	67/238(28.1%)	2/7(28.6%)	0.98
Gentamicin	48/238(20.2%)	2/7(28.6%)	0.58
3rd Gen Cephalosporins	11/238(4.6%)	0/7	0.56
Cefepime	15/238(6.4%)	1/7(14.3%)	0.31
Amoxicillin clavulanic acid	15/238(6.3%)	0/7	0.39
Cefaperazone sulbactam	37/238(15.5%)	1/7(14.3%)	0.92
Piperacillin tazobactam	19/238(8%)	0/7	0.54

No significant association was observed between colistin resistance and resistance to other antibiotics as only the carbapenem resistant isolates were tested for colistin susceptibility, which were resistant to most of the other antibiotics.

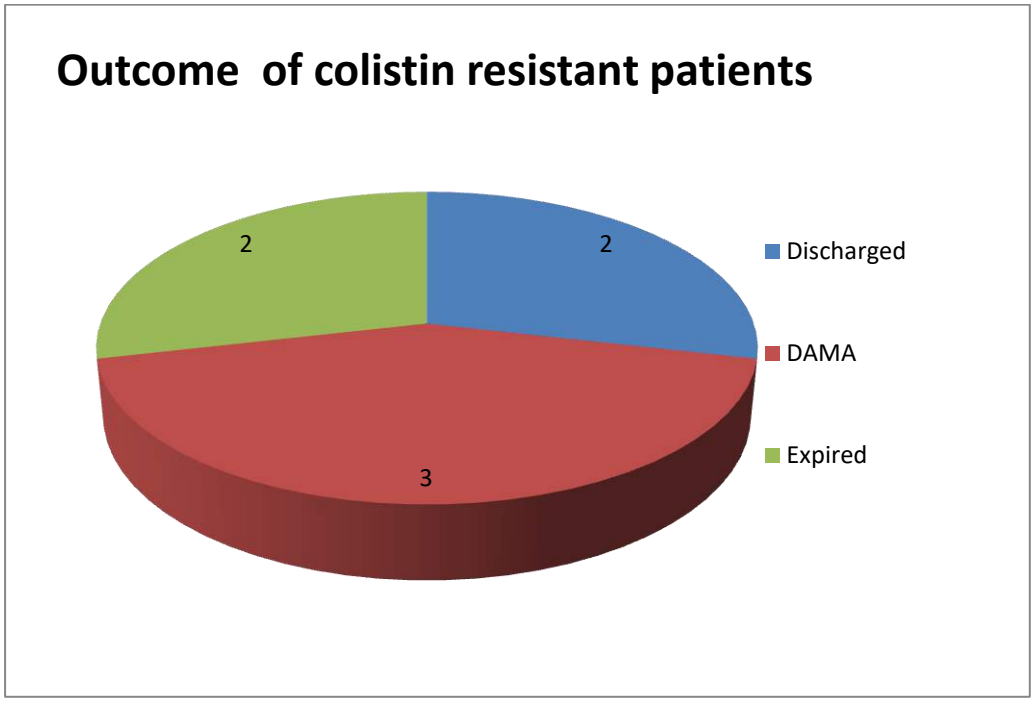
Table 20: Comparitive analysis between imipenem and meropenem resistant isolates with colistin susceptibility (n=245)

	IMIPENEM (R)	MEROPENEM (R)	BOTH(R)	TOTAL
COLISTIN (I)	8(3.2%)	20(8.2%)	210(85.7%)	238(97.1%)
COLISTIN (R)	1(0.5%)	3(1.2%)	3(1.2%)	7(2.9%)
TOTAL	9(3.7%)	23(9.4%)	216(86.9%)	245(100%)

Out of 8 only Imipenem resistant isolates (3.3%), one isolate (0.5%) was colistin resistant. Out of 24 only meropenem resistant isolates (9.8%), three isolates (1.2%) were colistin resistant.

Out of 216 both Imi/Mero resistant isolates, three isolates (1.2%) were colistin resistant

Fig 22: Outcome of the patients with colistin resistant isolates



Among 7 colistin resistant patients 2 (28.6%) were discharged, 2 (28.6%) expired and 3 (42.8%) discharged against medical advice.

Table 21: Comparison of clinical characteristics of patients with colistin intermediate and resistant isolates (n=245)

Characteristic	All	Intermediate	Resistant	P-value
N	245	238	7	
AGE				
0-20	38	38	0	0.914
21-40	38	37	1	0.927
41-60	91	89	2	0.634
61-80	70	66	4	0.089
81-100	8	8	0	0.176
GENDER				
Female	74	71	3	0.434
Male	171	167	4	0.434
AREA DISTRIBUTION				
WARD	148	147	1	0.005
ICU	97	91	6	0.005
COMORBIDITIES				
Diabetes mellitus	51	49	3	0.175
Malignancy	24	24	-	0.375
Hypertension	33	31	4	0.009
Cardiovascular	31	30	3	0.895
Chronic kidney ds	13	13	-	0.525
Neurological ds	10	8	2	0.028
RISK FACTORS				
ICU stay(>7days)	47	42	5	0.005
OUTCOME				
Discharged	134	132	2	0.159
DAMA	40	37	3	0.539
Expired	71	69	2	0.981

No significant correlation was observed between patient age, sex and colistin resistance. A significant association of colistin resistance with patient stay in ICU and co-morbidities (hypertension, neurological ds.) was observed. (p-value≤ 0.05)

DISCUSSION

Septicemia due Gram negative bacteria is a major cause of morbidity and mortality in hospitals. Gram negative isolates have become increasingly resistant to currently available antimicrobial agents thus leading to MDR isolates. These MDROs continues to endanger patients hospitalized with these infections hence, timely detection, identification, and AST are one of the most important functions of microbiology laboratory, especially in a tertiary care center.

This prospective study was conducted over a period of one year in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana. In this study, blood samples of suspected BSI patients were collected.

Predominantly Gram negative bacteria (GNB) were the most common cause of BSI. Out of the 720 isolates, 546(75.8%) were Gram-negative bacteria. Many other studies have reported Gram negative bacteria as the most common cause of BSIs.[32, 34, 35, 45] Ashish bajaj *et al.* reported slightly lower positivity (65.8%) while Mehta M. et al reported higher positivity (80.96%)of GNB in BSIs.[32, 35]

In our study majority of BSI caused by Gram negative isolates were seen in male patients (2:1). Majority of patients with BSI were in the age group of 51-60 years (23.4%), followed by patients aged 0-10 years (15.7%).

Leal *et al*. reported bacteremia due to GNB predominantly in male (61.5%)patients and in age group of 60 years or older (51.0%).[131]

Narayan Prasad Parajuli *et al*. and Tsegaye *et al.*in their study reported higher rates of bloodstream infections in pediatric patients (9.3%) compared to adult patients (6.6%).[132, 133]

Most common comorbidity associated in the patients with Gram negative BSI was diabetes mellitus 122(22.3%), followed by malignancy and hypertension 56(10.3%) which had been reported in various other studies. In a study by Amipara R *et al.* most common risk factor associated with patients with Gram negative BSI was diabetes mellitus (42%) followed by end-stage renal ds (25%).[134]

Among the Gram negative isolates, *E.coli* (31.8%) was the most common isolate obtained in our study followed by *Klebsiella spp.* (31.2%), *Acinetobacter spp.* (16.1%), *Salmonella spp.* (6.9%) and *Pseudomonas spp.* (6.3%). Similarly, Wong PH *et al.* reported *E. coli* (54%) as the most frequently isolated pathogens followed by *Klebsiella spp. (*19%) and *Pseudomonas aeruginosa* (4%) in their study.[135]

Though Palewar *et al.* reported *Acinetobacter* spp. (14.6%) and *Klebsiella* spp. (14%). as the most common GNB isolated in their study & Enterobacteriaceaeas a group accounted for 55.52% of all Gram negative septicaemia which was comparatively higher in our study. (75.4%).[34]

The AST pattern, among the Enterobacteriaceae*(E.coli and Klebsiella sp.)*family, revealed a high level of resistance to common antimicrobials such as cephalosporins (70-80%) and fluoroquinolones (67%). Similar results were noted in studies done by Ashish Bajaj *et al.* and Swati et al.[35, 45]

Members belonging to family Enterobacteriaceae revealed high resistance to the third-generation cephalosporins, quinolones, beta-lactam, and beta-lactamase inhibitor combinations. Gram negative bacteria are being reported with significant increase in resistance to these groups of antibiotics in other studies done worldwide.[44,136,137,138] This could be attributed to the irrational use of these antibiotics in hospital-care settings.

Similar to the study done by Fayaaz *et al*. susceptibility to amikacin(67%)revealed encouraging results against members of family Enterobacteriaceae.[139]

In case of non-lactose fermenting organismsisolated from blood, *Acinetobacter spp.* displayed better susceptibility to aminoglycosides, cefotaxime, amoxicillin clavulanic acid, cefaperazone sulbactam and ciprofloxacin (35-50%).High incidence of resistance was recorded for cefepime (73%) followed by piperacillin tazobactam (70%) and ceftazidime (70%). These results were in conformity with the study results of Neetu Gupta *et al.*[140] *Pseudomonas* isolates were mostly susceptible (55-82%) to common antimicrobial drugs(cefepime,

carbapenems, combination drugs and aminogycosides) which was in accordance to study done by Zhang Z. *et al*.[141]

In our study out of 546 isolates, 223(40.8%) isolates were observed susceptible to most of the classes of the antibiotics. Rest of the isolates showed resistance for many classes of antibiotics, were characterized as MDR (59.2%), XDR (30%) and PDR (0.4%). Maximum MDR isolates were *E.coli* (69.5%) followed by *Klebsiella spp.* (68.8%), *Acinetobacter spp.*(61.4%) and *Pseudomonas spp.* (41.2%). Maximum XDR isolates were *Klebsiella spp.*(52.4%) followed by *Acinetobacter spp.*(43.2%), *Pseudomonas spp.* (20.6%) and *E.coli* (14.9%). However, all the PDR isolates were *Klebsiella spp.* 2(1.2%). In a study by Basak *et al*., 37.1% isolates were MDR, 13.8% were XDR isolates and no PDR isolate was obtained. Amongst the GNB MDR strains, the most common MDR strain was *E.coli* (31.6%), followed by *Klebsiella pneumonia* (30%). Similarly, out of GNB XDR strains, *Pseudomonas aeruginosa* (32.2%) was the most common followed by *Klebsiella pneumoniae* (27.8%).[42] Aly and Balkhy reported that the most prevalent MDR organisms in their study was *E. coli (44%)* followed by *Klebsiella pneumonia* (20%).[43]

Carbapenems are used for treatment of infections caused by these multi-drug resistant organisms. However, carbapenem resistance in Gram-negative organisms is increasingly encountered in healthcare-associated infections in India.

In our study total carbapenem resistant isolates were 246(48.5%). Most of these isolates were obtained from the blood samples of the male (70%) patients. The median age of the patients was 48±2 years. Similarly, the study by Ravikant Porwal *et al.* reported (64%) carbapenem resistant isolates from male patients and the mean age of the patients was 52.3 years.[44] In our study infections due to carbapenem resistant organisms was seen more in patients admitted in ICUs (55.1%) than in wards (44%). These results were in concordance with other studies.[53,54]

Our studyidentified high prevalence of carbapenem resistance among members of Enterobacteriaceae(49%). *Klebsiella spp.* accounted for 62.9% resistance. In the study by Srujana mohanty *et al.;* 24.03% isolates were found to be carbapenem resistant Enterobacteriaceae (CRE), out of which 63.4% were *Klebsiella spp.*[12] A low CRE prevalence rate of 7.87% was reported in a study conducted in a tertiary care hospital from North India[70] while Gupta *et al.* reported carbapenem resistance varying from 17 to 22% among Enterobacteriaceaestrains.[71] Wattal *et al.* reported a high CRE prevalence rate ranging from 13 to 51% in a tertiary care hospital from Delhi.[72]

In the current study *Acinetobacter* (65.9%) and *Klebsiella sp.* (62.9%) showed higher resistance to carbapenems followed by *Pseudomonas*(38.2%). These results were in concordance with previous studies implicating these organisms as causes of healthcare-associated infections.[141,142]

Study by K. Sreeja Vamsi *et al.* showed 56% carbapenem resistance in *Klebsiella spp.*followed by *Pseudomonas spp.* (24%)[73] Another study reported highest carbapenem resistance in *Acinetobacter spp*.(53.5%) followed by *Pseudomonas spp*.[53] While in a study at Government Cancer Hospital, Marathwada carbapenem resistance was highest among *Pseudomonas* (25%) and *Klebsiella* (25%) followed by *Acinetobacter* (22%).[74]

Similar to various other studies carbapenem resistant isolates were seen significantly resistant to most of the other antibiotics in this study ($p<.05$).[73, 143]

However, 56.4% carbapenem resistant *E.coli* showed sensitivity to amikacin while A. Xul *et al.* reported 54% carbapenem resistant *Klebsiella pneumonia*[53] and 53.8% carbapenem resistant *Pseudomonas* isolates sensitive to cefepime and cefaperazone sulbactam.

Such a high prevalence of carbapenem resistance poses a major clinical challenge as it is considered the most active and potent agents against MDR gram negative pathogens. Colistin has emerged as the

cornerstone of therapy for CR-GNB. Breakpoint criteria and technical details for ST methods for the polymyxin class have been challenging. Rapid and reliable AST is necessary for its routine testing and appropriate therapeutic decision making.[16]

In our study susceptibility testing for colistin was done for 245 carbapenem resistant Gram negative isolates by BMD method and a total of 7(2.9%) isolates were observed resistant to colistin whereas Vitek-2 system failed to detect the colistin resistance among these isolates.

In study by Shaheen Shaikh *et al.* comparison of colistin susceptibility testing by VITEK 2 compact and BMD Method for carbapenem resistant isolates was done. Isolates had a discrepancy in MIC values by BMD method and MIC given by VITEK which indicates that in case of resistance to colistin by VITEK, BMD method must be used for correlation and to recheck the result.[144] similar to our study, Surbhi Khurana *et al.* reported in their study that the automatedVITEK®2 colistin interpretive results with reference BMD the categorical aggrement (CA) was (88%).[145] While a study by Parul Gupta *et al*[109] found a high level of agreement with the reference BMD method. They have reported disadvantage of the VITEK 2 was its low sensitivity to detect resistant subpopulations of *E. cloacae* isolates.

Mean age of the patients who had infection with these isolates was 58±1 years which was similarly reported (>55yr) in the study by John P Mills *et al*.[146]

Out of the total 7 colistin resistant isolates, 6(85.7%) were isolated from ICU samples, while only 1 isolate (14.3%) was from ward. Further it was noted that the indwelling devices like ET tube, catheters, tracheostomies and other external medical devices were present in all the patients harbouring colistin resistant isolates.

Colistin resistant isolates were majorly seen in patients (71.4%) with prolonged hospital stay (>1 weeks).Prolonged hospital stay of >2 weeks was reported as a significant risk factor for colistin resistance in study by Kaza P *et al*.[147] Comorbidies such as diabetes (3),

hypertension (4), CVS ds (1) and neurological ds (2)were observed in these patients. Similar comorbidities in colistin resistant patients were seen in a study byJohn P Mills *et al.*[146]

Among all the colistin resistant isolates, 5 were *Klebsiella sp.* and 1 each of was *Acinetobacter spp.*and *Pseudomonas spp.*Two isolates had colistin MIC of 4µg/ml while five isolates had MIC of 8µg/ml.

Similarly a study by Parul Gupta *et al.* from Jaipur, Rajasthan reported (5%)colistin resistant isolates by BMD method. Out of five resistant isolates, two isolates have MIC of 4 µg/ml while three isolates have MIC of 8 µg/ml. Resistant isolates included two *K. pneumonia*, two *P. aeruginosa* and one *A. baumannii*.[109] A study by John P Mills *et al.* reported (4%) of colistin-resistance among Enterobacterales in blood samples.[146]

Similarly in the study conducted in Los Angeles for over 6 years, (0.45%) Gram negative isolates were colistin resistant and (1.5%) of these were Colistin resistant *K. pneumoniae* isolates.[114]

A study from Vellore, conducted over a 3 year period, reported higher colistin resistance (14.9%) in Gram negative isolates with (20.6%) and (9.1%) resistance in *Klebsiella* and *Acinetobacter* respectively.[110]

Study by Laura J Rojas *et al,* observed 13% of colistin resistance among carbapenem resistant *Klebsiella pneumonieae*.[111] Anan MMG *et al.* at Cairo, Egypt reported very high (53%) colistin resistance in their study.[112]

Lower colistin resistance in our study could be due to use of antibiotics in the hospital according to the antibiotic policy.

In our study, out of 8 only imipenem resistant isolates (3.3%), one isolate (0.5%) was colistin resistant and out of 24 only meropenem resistant isolates (9.8%), three isolates (1.2%) were colistin resistant. Out of 216 both imipenem/meropenem resistant isolates, three isolates (1.2%) were colistin resistant.

In a study by Mohammad Qadi *et al*., Clinical Enterobacteriaceae isolates were obtained from microbiology laboratories in Gaza Strip. They were tested for their antimicrobial susceptibility by the disk

diffusion method and the MIC method for colistin. Only 39.0% of meropenem-resistant Enterobacteriaceae was susceptible to colistin, while 45.8% of imipenem-resistant Enterobacteriaceae was susceptible to colistin. The overall resistance to colistin was high (41%) among tested clinical isolates. [116]

In our study most of the colistin resistant isolates were resistant to other classes of antibiotics but no significant association was observed between colistin resistance and resistance to other antibiotics as we performed colistin susceptibility only among carbapenem resistant isolates which were already resistant to most of the other antibiotics. Colistin resistant isolates were susceptible few of the other antibiotics, 2 (28.6%) isolates to amikacin, gentamicin and 1(14.3%) to ciprofloxacin, cefepime and cefaperazone sulbactam. In a study by Kaza P *et al.* antimicrobial susceptibilty testing of both colistin-resistant and -sensitive isolates showed similar antibiograms. Few of the colistin resistant isolates were susceptible to the antimicrobials.[147] The results of the study by Santimaleeworagun W *et al.* showed susceptibility rates of colistin resistant GNB as 92.5%, 80.0%, and 70.0% to tigecycline , amikacin and gentamicin, respectively. [108]

In this study mortality was observed more in patients harbouring carbapenem resistant isolates (14%) than in patients with carbapenem sensitive isolates (7.6%). Capone A.*et al.* in their study reported mortality rate of patients infected with non carbapenem resistant (12%) isolates and carbapenem resistant (40%) respectively.[148]

In our study mortality among patients with colistin-resistant isolates 28.6%.Similarly study by Prawang *et al*. reported higher (40.6%) mortality rates among patients infected with colistin-resistant isolates[149]. Capone A. *et al.* in their study reported mortality rate of patients infected with colistin-resistant isolates (61%).[148] DAMA patients are terminally ill, so if they are included in death then mortality

rate will be 45.1% for patients with carbapenem resistant infections and 71.4% of the patients with colistin resistant infections.

Therefore, colistin resistance cannot be underestimated as there are no new antibiotics left against Gram negative organisms. This precious antibiotic must be used judiciously after appropriate antibiotic susceptibility testing and can be preserved by following antibiotic stewardship.

SUMMARY

The present study entitled to study colistin susceptibility of Gram negative isolates from the blood samples was conducted in Department of Microbiology at Dayanand Medical College and Hospital, Ludhiana over a period of one year.

- Gram negative bacteria were the most common cause of BSI.
- Out of the total 720 isolates obtained from 14,175 Blood samples, 546(75.8%) were GNB.
- In our study majority of BSI caused by Gram negative isolates were seen in male patients (2:1).
- Majority of patients with BSI were in the age group of 51-60 years (23.4%), followed by patients aged 0-10 years (15.7%).
- Most common comorbidities associated with patients with Gram negative BSI was diabetes mellitus (22.3%), followed by malignancy and hypertension (10.3%)
- Among gram negative isolates *E.coli* (31.8%) was the most common isolate obtained followed by *Klebsiella spp.* (31.2%), *Acinetobacter spp.*(16.1%), *Salmonella spp.*(6.9%) and *Pseudomonas spp.* (6.3%).
- Time to positivity for most of the isolates was 12-24 hours (58.1%).
- Among the Gram negative isolates maximum sensitivity was seen to amikacin (61.7%) followed by imipenem (56%), cefaperazone sulbactam (52.6%), meropenem (52.3%) and gentamicin (50.3%).
- High resistance was seen to cephalosporins (70%), ciprofloxacin (70%) followed by amoxicillin clavulanic acid (62.3%) and cotrimoxazole (60.6%).
- The antimicrobial susceptibility pattern, among the Enterobacteriaceae (*E.coli* and *Klebsiella spp.)* family, revealed a high level of resistance to common antimicrobials such as cephalosporins (70-80%) and fluoroquinolones

(70%).Susceptibility to amikacin (67%) however, revealed encouraging results.

- *Acinetobacter spp.* showed relatively low susceptibility to aminoglycosides (37%) as compared to the other GNB and better susceptibility was observed to cefotaxime (36.4%) as compared to other cephalosporins (27-30%). Moderate susceptibility was seen to ciprofloxacin (35.2%) and cotrimoxazole (37.5%). Though, *Pseudomonas spp.* was seen susceptible (55-82%) to most of the antibiotics.
- Out of the 546 gram negative isolates MDR, XDR and PDR were 323(59.2%), 164(30%), 2(0.4%).*E.coli* (69.5%) was the most common MDR strain followed by *Klebsiella spp.* (68.8%). Among XDR *Klebsiella spp.* (52.4%) was most common followed by *Acinetobacter spp.* (43.2%)
- 507 gram negative isolates (39 *Salmonella spp.* excluded) were tested for carbapenem susceptibility. Out of these, 246 (48.5%) were found carbapenem resistant.
- BSI due carbapenem resistant Gram negative isolates was observed more among male patients (70%). The median age of patients with carbapenem resistant isolates was 48±2years.
- Patients admitted in ICUs (55.1%) had more infections due to CR-GNB as compared to the patients admitted in the wards (40%).
- Maximum carbapenem resistance was observed among *Acinetobacter spp.* (65.9%) followed by *Klebsiella spp.* (62.9%); *Pseudomonas spp.* (38.2%); *Ecoli*(35.6%); *Proteus mirabilis* (33.3%) and *Enterobacter cloacae complex* (26.3%).
- Carbapenem resistant *Klebsiella* spp. and *Acinetobacter spp.* showed very high resistance to other classes of antibiotics. Carbapenem resistant *E. coli* was relatively susceptible to amikacin (56.4%), while very low susceptibility was seen to cephalosporins (<5%) and ciprofloxacin (<5%). Carbapenem resistant *Pseudomonas* showed good susceptibility to

cefaperazone sulbactam and cefepime (53.8%) as compared to other organisms.

- Carbapenem sensitive GNB showed better antimicrobial susceptibility to the other classes of antibiotics as compared to carbapenem resistant GNB. Significant association was seen between carbapenem resistant isolates and resistance to other classes of antibiotics. (p-value <0.05)
- A significant association of carbapenem resistant infections with patient stay in ICU and comorbidities (Hypertension, cardiovascular disease and chronic kidney disease) was observed.
- DAMA (7.9%) and Death (14%) was observed more in patients harbouring carbapenem resistant isolates.
- Isolates resistant to carbapenems were further tested by BMD method for determination of colistin MIC. Out of the remaining 245 carbapenem resistant isolates, only 7 isolates were found resistant to colistin by BMD.
- Mean age of the patients from which colistin resistant isolates were obtained was 58±1 years. Median length of stay in the hospital was 14 days.
- Out of the total 7 colistin resistant isolates, 6(85.7%) were isolated from ICU samples, while only 1 isolate (14.3%) was from ward.
- Colistin resistant isolates were majorly 5 (71.4%) obtained from patients with prolonged hospital stay (>1 week).
- A significant association of colistin resistance with patient stay in ICU was observed.
- Further it was noted that the Indwelling devices (ET tube, catheters, tracheostomies etc) and underlying comorbidities were present in the patients harbouring colistin resistant isolates. Comorbidies present were Diabetes, Hypertension, Neurological disease and Cardiovasular system disease.

- Among the colistin resistant isolates, mostly were *Klebsiella spp*. (71.4%) followed by *Acinetobacterspp.* (14.3%) &*Pseudomonas spp*. (14.3%). Colistin resistance was not seen in the other carbapenem resistant Gram negative isolates.
- 7(2.9%) isolates found resistant (MIC ≥4 µg/ml) to colistin by BMD method were found intermediate sensitive to colistin by VITEK-2 system (MIC ≤0.5 µg/ml).
- Among the colistin resistant isolates MIC of ≥4 µg/ml was observed in 2 isolates*(Klebsiella spp*.) and ≥8µg/ml in 5 isolates*(Klebsiella spp., Acinetobacter spp.and Pseudomonas spp.*).
- Out of 8 only imipenem resistant isolates (3.3%), one isolate (0.5%) was colistin resistant.Out of 24 only meropenem resistant isolates (9.8%), three isolates (1.2%) were colistin resistant. Out of 216 both imi/mero resistant isolates, three isolates (1.2%) were colistin resistant
- Among 7 colistin resistant patients 2 (28.6%) were discharged, 2 (28.6%) expired and 3 (42.8%) discharged against medical advice.

CONCLUSION

The following conclusions were drawn from the study:-

Predominantly Gram negative bacteria were the most common cause of BSI, exhibiting resistance to clinically important antimicrobial agents. This could be attributed to the irrational use of these antibiotics in hospital-care settings.

Most of these Gram negative isolates were characterized as multi drug resistant. Carbapenems areused for treatment of infections caused by these multi-drug resistant organisms. The resistance to carbapenems was high in the study. More percentage of carbapenem resistance was seen in patients admitted in ICUs. A significant association was seen between carbapenem resistant isolates and resistance to other classes of antibiotics. Death was observed more in patients harbouring carbapenem resistant isolates.

BMD is a reliable method for determination of MIC of colistin.VITEK-2 system failed to detect the colistin resistance among the isolates, hence colistin MIC by VITEK-2 must be rechecked by BMD method.Lower colistin resistance in our study could be due to use of antibiotics in the hospital according to the antibiotic policy. Majority of the patients with colistin resistant infections were from ICUs, had indwelling devices, comorbidities and prolonged hospital stay. A significant association of colistin resistance with patient stay in ICU was observed.

Most of the laboratories do not perform the colistin susceptibility (MIC) test as it is a tedious procedure. Hence underreporting of the colistin resistant bacteria is an important reason for misuse of this nephrotoxic antibiotic. Mortality rate among the patients with infections due to colistin resistant isolates was comparatively high. Therefore, colistin resistance cannot be underestimated as there are no new antibiotics left against Gram negative organisms. This precious antibiotic must be used judiciously after appropriate antibiotic susceptibility testing and could be preserved by following antibiotic stewardship.

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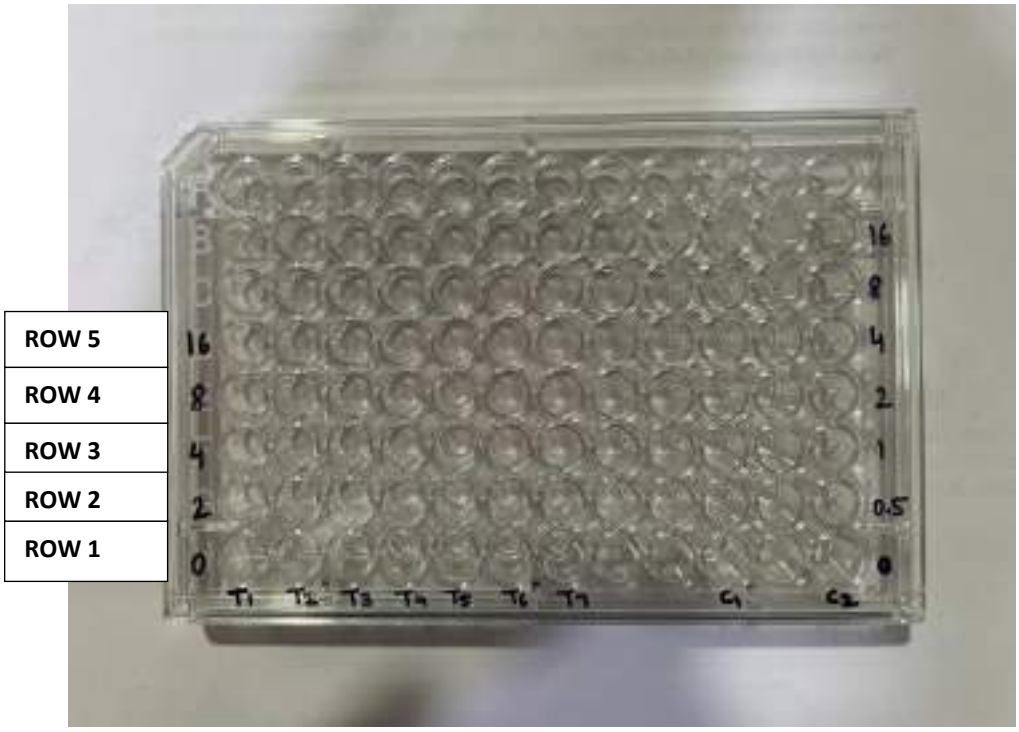
Picture 1: BLOOD CULTURE BOTTLES

Picture 2: BACTEC 9240-BLOOD CULTURE AUTOMATED SYSTEM

Picture 3: BACT/ALERT-BLOOD CULTURE AUTOMATED SYSTEM

Picture 4: VITEK-2 system



Picture 5: Markings on 96-well Microtiter plate

ROW 1: No drug (T1-T7-test organism C1-negative control C2-positive control)

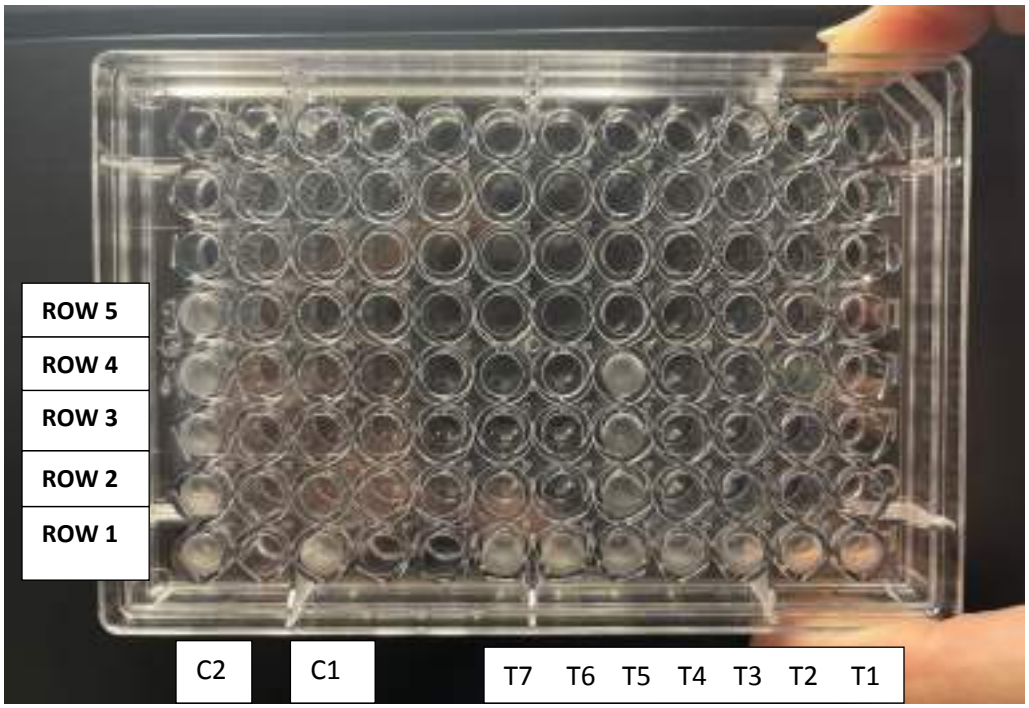
ROW 2: Colistin MIC 2µg/ml- test organism, Colistin MIC 0.5µg/ml- control organism

ROW 3:Colistin MIC 4µg/ml- test organism, Colistin MIC 1µg/ml- control organism

ROW 4:Colistin MIC 8µg/ml- test organism, Colistin MIC 2µg/ml- control organism

ROW 5:Colistin MIC 16µg/ml- test organism, Colistin MIC 4µg/ml- control organism

Final concentration in well 16ug/ml, 8ug/ml, 4ug/ml, 2ug/ml respectively for test organism and upto 0.5ug/ml for controls.



Picture 6: BMD Test

ROW 1: No drug (T1-T7-test organism C2-positive control C1- negative control)

Colistin MIC 8µg/ml in test organism (T5), Colistin MIC of 4µg/ml in positive control organism

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS						
		NAME	Age	Sex					DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
1	875369	D	60	M	2-Jan	GASTRO	Klebsiella pneumoniae	CIRRHOSIS, CLD	-	-	-	-	-	-
2	873667	MK	45	M	4-Jan	GASTRO	Acinetobacter baumannii	ASCITIS	-	-	-	-	-	-
3	876590	TK	51	M	5-Jan	MEDICINE WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
4	873200	VP	65	M	5-Jan	NEUROLOGY WARD	Klebsiella pneumoniae	ICH	-	YES	-	-	-	-
3	873654	T	35	M	5-Jan	NEUROLOGY WARD	Acinetobacter baumannii	IDH	-	-	-	-	-	-
6	265807	PS	80	M	6-Jan	GASTRO	Klebsiella pneumoniae	PANCREATITIS	-	-	-	-	-	-
7	743458	DS	85	M	6-Jan	PCCU	Acinetobacter baumannii	AKD	-	-	-	-	-	-
8	848542	S	29	F	9-Jan	MEDICINE WARD	Salmonella typhi	AFI, TROPICAL FEVER	-	-	-	-	-	-
9	878849	YV	57	M	10-Jan	EMG	Ecoli	HYPERPARATHYROIDISM	-	-	-	-	-	-
10	464783	KC	80	M	10-Jan	EMG	Ecoli	AKD	-	-	-	-	-	-
11	879422	PS	3	M	10-Jan	MEDICINE WARD	Pseudomonas aeruginosa	H1N1 POSITIVE	-	-	-	-	-	-
12	878455	SS	76	M	10-Jan	HDHI	Ecoli	HTN,CAD,MI, VERTIGO	-	YES	-	-	-	-
13	863402	SD	71	F	11-Jan	ENDO	Pseudomonas aeruginosa	MYELODYSPLASTIC SYNDROME WITH TCP	-	-	-	-	-	-
14	880279	P	2	M	13-Jan	P ICU	Pseudomonas aeruginosa	OPC POISONING	-	-	-	-	-	-
15	880306	SS	74	M	13-Jan	MEDICINE WARD	Ecoli	DM2, LOOSE STOOL	YES	-	-	-	-	-
16	367710	SC	65	M	13-Jan	ONCO	Ecoli	LYMPHOMA	-	-	-	-	-	-
17	870698	S	4	M	13-Jan	B-ICU	Klebsiella pneumoniae	75% BURN	-	-	-	-	-	-
18	880624	TS	23	M	13-Jan	HDHI	Pseudomonas aeruginosa	IV DRUG ABUSER, SEPSIS, AKI, IE, SEVERE TR	-	-	-	YES	-	-
19	880989	KS	43	M	14-Jan	ENDO	Klebsiella pneumoniae	AFI,ARTHRITIS	-	-	-	-	-	-
20	21439	RG	11	F	15-Jan	ONCO	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
21	6365	DP	10	M	15-Jan	PAEDIATRIC WARD	Salmonella typhi	ENTERIC FEVER	-	-	-	-	-	-
22	881619	JK	75	F	16-Jan	SURGERY WARD	Acinetobacter baumannii	SUBACUTE INTESTINAL OBST	-	-	-	-	-	-
23	841101	KS	60	M	18-Jan	NEPHRO WARD	Ecoli	CKD, SEPSIS, PYELONEPHRITIS	YES	YES	-	-	YES	-
24	882795	KS	78	M	18-Jan	GASTRO	Ecoli	PANCREATITIS, SUBACUTE INTESTINAL OBST	-	-	-	-	-	-
25	348316	AS	74	M	18-Jan	HDHI	Acinetobacter baumannii	CARDIOEMBOLIC SHOCK, AKI	YES	YES	-	-	-	-
26	883308	G	15	M	18-Jan	PAEDIATRIC WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
27	145513	SS	83	F	19-Jan	MEDICINE WARD	Klebsiella pneumoniae	CKD	-	-	-	-	YES	-
28	883426	RD	24	M	19-Jan	MEDICINE WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
29	884011	KK	30	M	20-Jan	MEDICINE WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
30	478478	SS	71	M	21-Jan	MEDICINE WARD	Ecoli	UTI, BENIGN PROSTATIC HTN	YES	YES	-	-	-	-
31	883294	UG	73	F	21-Jan	M-ICU	Klebsiella pneumoniae	AKD, ALD	YES	-	-	-	-	-
32	390972	KK	34	M	21-Jan	MEDICINE WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
33	590515	S	73	M	22-Jan	HDHI	Ecoli	UTI, CAD	YES	-	-	-	-	-
34	27828	PK	47	F	22-Jan	NEPHRO WARD	Ecoli	RENAL ALLOGRAFT RUPTURE	-	-	-	-	YES	-
35	867228	SR	75	F	22-Jan	HDHI	Klebsiella pneumoniae	HYPOXIC INJURY, COMPLETE HEART BLOCK	-	-	-	YES	-	-
36	885979	PN	71	M	22-Jan	M-ICU	Pseudomonas aeruginosa	SEPSIS, DCMP, GANGRENE, AKI, JAUNDICE	YES	YES	-	YES	-	-
37	886544	AS	32	M	23-Jan	PCCU	Klebsiella pneumoniae	ARDS	-	-	-	-	-	-
38	885851	GD	46	F	23-Jan	GASTRO	Klebsiella pneumoniae	CLD, ANAEMIA	YES	-	-	-	-	-
39	873571	MR	65	M	23-Jan	SURGERY WARD	Klebsiella pneumoniae	OESP ULCER, HAEMMRHOIDS, LAPROTOMY	-	-	-	-	-	-
40	885334	BS	51	M	25-Jan	M-ICU	Acinetobacter baumannii	AKI, OLD CVA	-	-	-	YES	-	-
41	881091	TK	37	F	26-Jan	MEDICINE WARD	Acinetobacter baumannii	ENTERIC FEVER	-	-	-	-	-	-
42	3915	C	10	F	26-Jan	PAEDIATRIC WARD	Salmonella typhi	COMPLICATED ENTERIC FEVER	-	-	-	-	-	-
43	889965	JS	15	M	30-Jan	PAEDIATRIC WARD	Salmonella typhi	CKD	-	-	-	-	YES	-
44	151201	PL	79	M	31-Jan	HDHI	Acinetobacter baumannii	DIABETIC NEPHROPATHY, HYPOTHYROIDISM, LEFT PL EFFUSION	YES	YES	-	-	-	-
45	843672	D	4	M	31-Jan	ONCO	Acinetobacter baumannii	ALL	-	-	-	-	-	-
46	889334	AS	30	M	31-Jan	HDHI	Acinetobacter baumannii	CABG	-	-	-	YES	-	-
47	835074	SS	4	M	31-Jan	ONCO	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
48	308738	S	7	M	31-Jan	PAEDIATRIC WARD	Salmonella typhi	ENTERIC FEVER	-	-	-	-	-	-
49	719738	DS	2	M	31-Jan	ONCO	Ecoli	ALL	-	-	-	-	-	-
50	7504	ST	54	M	31-Jan	MEDICINE WARD	Salmonella typhi	AFI	-	-	-	-	-	-
51	390932	M	24	F	31-Jan	MEDICINE WARD	Salmonella typhi	UTI, SEPSIS	-	-	-	-	-	-
52	890922	DS	75	M	31-Jan	MEDICINE WARD	Klebsiella pneumoniae	UTI, SEPSIS, HYPOTHYROIDISM	-	YES	-	-	-	-
53	891117	N	9	F	1-Feb	PAEDIATRIC WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
54	878423	SB	34	F	1-Feb	S-ICU	Klebsiella pneumoniae	PUERPERAL SEPSIS, AC. FATTY LIVER, INTEST OBST	-	-	-	-	-	-
55	891287	SK	24	M	2-Feb	CHEST	Klebsiella pneumoniae	FEVER, COUGH	-	-	-	-	-	-
56	184406	GS	56	M	2-Feb	NEPHRO WARD	Acinetobacter baumannii	CKD	-	-	-	-	YES	-
57	891851	MS	67	M	3-Feb	MEDICINE WARD	Ecoli	SEPSIS	-	-	-	-	-	-
58	752997	GS	69	M	3-Feb	NEPHRO WARD	Klebsiella pneumoniae	CKD	-	-	-	-	YES	-
59	864972	MD	86	M	3-Feb	SEMI PVT	Klebsiella pneumoniae	AKD	-	-	-	-	-	-
60	752997	GS	69	M	3-Feb	DIALYSIS	Klebsiella pneumoniae	CKD	YES	-	-	-	YES	-
61	892093	S	62	F	4-Feb	NEPHRO WARD	Ecoli	CKD, SEPSIS	YES	-	-	-	YES	-
62	891586	GS	42	M	5-Feb	GASTRO	Ecoli	ACUTE CHOLINGITIS	-	-	-	-	-	-
63	893123	GS	30	M	5-Feb	MEDICINE WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
64	893068	J	5	M	5-Feb	PAEDIATRIC WARD	Salmonella typhi	AFI WITH LOOSE STOOL	-	-	-	-	-	-
65	894704	AA	14	M	7-Feb	P-ICU	Salmonella typhi	COMPLICATED ENTERIC FEVER	-	-	-	-	-	-
66	893481	KK	69	M	8-Feb	HDHI	Klebsiella pneumoniae	HTN, CVA	-	YES	-	-	-	-
67	895106	S	45	M	9-Feb	MEDICINE WARD	Klebsiella pneumoniae	PLEURAL EFFUSION	-	-	-	-	-	-
68	872711	SS	51	M	10-Feb	NEUROLOGY WARD	Klebsiella pneumoniae	HYPOXIC BRAIN INJURY	-	-	-	-	-	YES
69	280368	GS	22	M	10-Feb	MEDICINE WARD	Salmonella typhi	ENTERIC FEVER	-	-	-	-	-	-
70	894661	KS	82	M	10-Feb	S-ICU	Ecoli	SHOCK, SEPSIS, CHOLELITHIASIS	-	-	-	-	-	-
71	891965	S	16	M	10-Feb	ONCO	Ecoli	AML WITH FEBRILE ILLNESS	-	-	-	-	-	-
72	896378	AK	60	M	10-Feb	HDHI	Klebsiella pneumoniae	OLD CVA, DM2, CKD	YES	-	-	YES	-	-
73	876827	PK	53	M	11-Feb	NEPHRO WARD	Klebsiella pneumoniae	CKD	-	YES	-	-	YES	-
74	893454	HK	30	F	11-Feb	PCCU	Ecoli	SEPSIS	-	-	-	-	-	-
75	898334	LK	58	M	13-Feb	MEDICINE WARD	Ecoli	AFI,	YES	YES	-	-	-	-
76	781224	H	7	F	14-Feb	ONCO	Pseudomonas aeruginosa	ALL	-	-	-	-	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																											RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
			MDR / XDR /PDR		AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
1	875369	-	-	R	S	S	S	S	S	S	R	-	R	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	<2	I	DAMA	-
2	873667	-	XDR	R	R	R	R	M	R	R	R	-	R	R	R	S	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	-
3	876590	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
4	873200	-	XDR	S	S	S	S	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
3	873654	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
6	265807	-	-	R	S	S	S	S	S	S	R	-	R	S	-	-	-	S	-	-	-	S	-	R	-	-	-	-	-	S	<2	I	DIS	-
7	743458	-	-	R	S	S	S	MS	R	R	R	-	R	S	R	R	R	-	-	-	S	R	-	-	-	-	-	-	-	S	<2	I	LAMA	5
8	848542	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
9	878849	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
10	464783	-	-	R	S	S	R	S	S	MS	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
11	879422	-	-	R	S	S	R	S	R	R	R	-	R	S	S	R	-	-	-	-	S	S	S	-	-	-	-	-	-	S	<2	I	DIS	-
12	878455	-	XDR	R	S	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
13	863402	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	<2	I	DIS	-
14	880279	-	MDR	R	S	S	R	S	S	R	R	-	R	S	S	R	-	-	-	-	S	S	S	-	-	-	-	-	-	S	<2	I	DIS	3
15	880306	-	-	S	S	S	S	S	S	S	S	-	S	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
16	367710	-	XDR	R	S	S	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
17	870698	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	30
18	880624	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
19	880989	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
20	21439	YES	-	R	S	S	R	S	S	S	R	-	R	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	<2	I	DIS	-
21	6365	-	-	-	-	-	S	-	-	-	-	-	-	M	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
22	881619	-	-	S	S	S	S	S	S	s	S	-	S	S	S	R	S	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
23	841101	-	MDR	S	S	S	R	S	R	R	S	-	S	R	-	-	-	R	-	-	-	R	-	S	-	-	-	-	-	S	-	-	LAMA	4
24	882795	-	MDR	R	S	S	R	S	S	R	S	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
25	348316	-	-	S	S	S	S	S	S	s	S	-	S	S	S	R	S	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
26	883308	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
27	145513	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
28	883426	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
29	884011	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
30	478478	-	-	S	S	S	R	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
31	883294	-	-	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXPIRED	2
32	390972	-	-	-	-	-	S	-	-	-	-	-	-	M	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
33	590515	-	MDR	S	S	S	R	S	S	MS	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
34	27828	-	MDR	S	S	S	R	S	S	R	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	EXP	10
35	867228	-	XDR	R	R	S	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
36	885979	-	XDR	R	R	R	R	R	R	R	R	-	M	R	R	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	>8	R	EXPIRED	11
37	886544	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	8
38	885851	-	-	S	S	S	S	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
39	873571	-	XDR	R	S	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
40	885334	-	-	S	S	S	S	S	s	S	S	-	S	S	S	R	S	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	8
41	881091	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	EXPIRED	13
42	3915	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
43	889965	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
44	151201	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
45	843672	YES	XDR	R	R	S	R	R	R	R	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
46	889334	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
47	835074	YES	XDR	R	S	S	R	R	R	R	R	-	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
48	308738	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
49	719738	YES	-	S	S	S	R	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
50	7504	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	R	S	S	S	S	S	-	-	-	DIS	-
51	390932	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
52	890922	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
53	891117	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	MS	-	-	S	S	S	S	S	S	-	-	-	DIS	-
54	878423	-	XDR	R	R	R	R	R	R	MS	-	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	4	R	DIS	16
55	891287	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	4
56	184406	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
57	891851	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	M	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
58	752997	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
59	864972	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
60	752997	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
61	892093	-	MDR	S	S	S	R	S	S	MS	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	EXP	2
62	891586	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
63	893123	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	S	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
64	893068	-	-	-	-	-	S	-	-	-	-	-	-	MS	-	-	-	S	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
65	894704	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	4
66	893481	-	-	S	M	R	S	S	S	S	S	-	S	R	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
67	895106	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	LAMA	-
68	872711	-	-	S	R	R	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
69	280368	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
70	894661	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	12
71	891965	YES	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
72	896378	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
73	876827	-	MDR	S	S	S	R	S	S	R	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	17
74	893454	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	7
75	898334	-	-	S	S	S	R	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
76	781224	YES	MDR	S	S	S	S	MS	R	S	S	-	S	S	R	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS	DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
		NAME	Age	Sex										
77	898912	S	63	M	14-Feb	NEPHRO WARD	Ecoli	CKD	-	-	-	-	YES	-
78	22744	A	17	M	14-Feb	PAEDIATRIC WARD	Salmonella typhi	AFI	-	-	-	-	-	-
79	797648	BK	63	F	15-Feb	NEPHRO WARD	Ecoli	CKD	YES	-	-	-	YES	-
80	897833	Bm	29	M	15-Feb	SURGERY WARD	Ecoli	PANCREATIC NECROSECTOMY	-	-	-	-	-	-
81	828614	AS	1	F	17-Feb	PAEDIATRIC WARD	Salmonella typhi	FEVER WITH LOOSE STOOL	-	-	-	-	-	-
82	334696	AkM	71	M	17-Feb	ENDO	Proteus mirabilis	FEVER, PARKINSON'S DS	-	-	-	-	-	-
83	901582	GS	22	M	18-Feb	MEDICINE WARD	Salmonella typhi	AFI	-	-	-	-	-	-
84	902214	GS	17	F	19-Feb	GASTRO	Acinetobacter baumannii	HEPATITIS	-	-	-	-	-	-
85	900526	JS	40	M	22-Feb	GASTRO	Klebsiella pneumoniae	CIRRHOSIS, ALT SENSORIUM	-	-	-	-	-	-
86	563493	SK	5	F	22-Feb	ONCO	Ecoli	ALL	-	-	-	-	-	-
87	715800	AB	6	M	22-Feb	PAEDIATRIC WARD	Acinetobacter baumannii	PAIN ABD, WEAKNESS LL	-	-	-	-	-	-
88	904268	AS	62	M	23-Feb	MEDICINE WARD	Klebsiella pneumoniae	H/O FALL, DENGUE SEROLOGY POSITIVE	YES	YES	-	-	-	-
89	885310	AS	60	M	24-Feb	GASTRO	Klebsiella pneumoniae	PANCREATITIS	-	-	-	-	-	-
90	901534	MK	35	F	25-Feb	B-ICU	Acinetobacter baumannii	70% FLAME BURN	-	-	-	-	-	-
91	906507	A	62	F	26-Feb	PCCU	Ecoli	CKD, COPD	YES	YES	-	-	YES	-
92	890489	NK	58	F	26-Feb	MEDICINE WARD	Klebsiella pneumoniae	JAUNDICE ON ATT	-	-	-	-	-	-
93	902907	JK	23	F	28-Feb	M-ICU	Acinetobacter baumannii	SEPSIS	-	-	-	-	-	-
94	182908	KG	73	M	28-Feb	M-ICU	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
95	910265	DS	76	M	3-Mar	M-ICU	Klebsiella pneumoniae	SEPSIS, SHOCK	-	YES	-	-	-	-
96	646565	SS	46	M	6-Mar	M-ICU	Klebsiella pneumoniae	DVT	-	-	-	-	-	-
97	448467	VR	54	F	6-Mar	M-ICU	Klebsiella pneumoniae	CKD, SEPSIS	YES	-	-	-	YES	-
98	911671	Bk	48	F	6-Mar	S-ICU	Ecoli	SEPSIS	-	-	-	-	-	-
99	911667	SS	22	F	5-Mar	MEDICINE WARD	Salmonella typhi	FEVER, VOMITING	-	-	-	-	-	-
100	901354	KL	66	M	6-Mar	EICU	Ecoli	SEPSIS	-	-	-	-	-	YES
101	908588	G	15	F	6-Mar	M-ICU	Ecoli	BRONCHOPNEUMONIA, CEREBRAL PALSY	-	-	-	-	-	-
102	912694	M	14	F	7-Mar	PAEDIATRIC WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
103	891780	B	49	F	8-Mar	GASTRO	Ecoli	PAIN ABDOMEN	-	-	-	-	-	-
104	885606	S	47	M	9-Mar	GASTRO	Ecoli	CLD	-	-	-	-	-	-
105	913431	GS	57	M	9-Mar	MEDICINE WARD	Ecoli	DIARRHOEA	-	-	-	-	-	-
106	272224	BR	72	M	10-Mar	NEPHRO WARD	Ecoli	CKD	YES	-	-	-	YES	-
107	914757	GK	65	F	11-Mar	HDHI	Ecoli	RHD WITH AFI, MS, SEPSIS	-	-	-	YES	-	-
108	914646	SR	45	F	11-Mar	NEPHRO WARD	Salmonella typhi	CKD	-	-	-	-	YES	-
109	237135	RPS	60	M	12-Mar	SURGERY WARD	Ecoli	PANCREATIC NECROSECTOMY	-	-	-	-	-	-
110	907865	JS	36	M	13-Mar	T-ICU	Klebsiella pneumoniae	RSA WITH SHOCK, SEPSIS	YES	-	-	-	-	-
111	915955	BS	50	M	13-Mar	ONCO	Ecoli	CA PANCREAS	-	-	-	-	-	-
112	702308	SS	45	M	13-Mar	M-ICU	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
113	909336	N	80	F	12-Mar	MEDICINE WARD	Ecoli	FEVER	-	-	-	-	-	-
114	688271	M	84	M	14-Mar	PCCU	Klebsiella pneumoniae	INTERSTITIAL LUNG DS	YES	YES	-	-	-	-
115	915071	KK	62	F	15-Mar	HDHI	Acinetobacter baumannii	ANT. WALL MI, MOD MR	YES	-	-	YES	-	-
116	915583	SK	55	M	16-Mar	GASTRO	Pseudomonas aeruginosa	JAUNDICE	-	-	-	-	-	-
117	165207	AS	54	M	17-Mar	MEDICINE WARD	Ecoli	SEPSIS	YES	YES	-	-	-	-
118	917931	S	50	F	17-Mar	NEPHRO WARD	Ecoli	CKD	YES	YES	-	-	-	-
119	368859	JS	59	M	17-Mar	NEPHRO WARD	Klebsiella pneumoniae	CKD	YES	-	-	-	-	-
120	158810	SK	63	F	17-Mar	MEDICINE WARD	Citrobacter koseri	FEVER WITH WEAKNESS	-	-	-	-	-	-
121	902893	RN	55	M	17-Mar	NEPHRO WARD	Achromobacter xylosans	TUBERCULAR MENINGITIS, FEVER	-	-	-	-	-	YES
122	909443	JS	53	M	18-Mar	HDHI	Ecoli	ACUTE CVA	YES	YES	-	YES	-	-
123	918372	GK	36	F	18-Mar	HDU	Salmonella typhi	FEVER	-	-	-	-	-	-
124	917494	JU	75	M	16-Mar	HDU	Proteus mirabilis	SEPSIS	YES	-	-	-	-	-
125	774837	SB	56	F	20-Mar	NEPHRO WARD	Ecoli	CKD	YES	-	-	-	YES	-
126	917931	S	50	F	19-Mar	NEPHRO WARD	Ecoli	CKD	YES	YES	-	-	YES	-
127	919227	JS	32	M	19-Mar	T-ICU	Enterobacter cloacae complex	RSA	-	-	-	-	-	-
128	918741	JS	57	M	19-Mar	GASTRO	Stenotrophomonas maltophilia	CIRRHOSIS	YES	-	-	-	-	-
129	918489	BS	68	M	19-Mar	SURGERY WARD	Stenotrophomonas maltophilia	LIVER ABSCESS	YES	-	-	-	-	-
130	919270	NS	1	M	20-Mar	B-ICU	Pseudomonas aeruginosa	45% BURN	-	-	-	-	-	-
131	919443	KM	1	F	20-Mar	P-ICU	Salmonella typhi	SEIZURES	-	-	-	-	-	YES
132	914758	DS	29 D	M	20-Mar	P-ICU	Acinetobacter baumannii	PRETERM ON VENTILATOR SUPPORT	-	-	-	-	-	-
133	911052	MK	5	F	20-Mar	ENDO	Acinetobacter lwoffii	GBS	-	-	-	-	-	-
134	920006	KK	11	F	22-Mar	PAEDIATRIC WARD	Salmonella typhi	TROPICAL FEVER	-	-	-	-	-	-
135	919305	R	34	F	22-Mar	GYNAECOLOGY WARD	Achromobacter xylosans	POSTPARTUM HAEMMRHAGE HAEMATOMA	-	-	-	-	-	-
136	60425	GS	59	M	22-Mar	HDHI	Enterobacter cloacae complex	LV DYSFUNCTION, HYPOTHYROIDISM, MR, CKD	-	-	-	YES	YES	-
137	920076	KD	74	F	23-Mar	MEDICINE WARD	Ecoli	AFI	-	YES	-	-	-	-
138	920188	SK	73	F	23-Mar	GASTRO	Stenotrophomonas maltophilia	PANCREATITIS	-	-	-	-	-	-
139	886543	PK	57	F	24-Mar	HDHI	Serratia marscenses	INF WALL MI	YES	-	-	YES	-	-
140	866714	VV	73	F	26-Mar	MEDICINE WARD	Acinetobacter lwoffii	LEFT SIDED WEAKNESS	YES	YES	-	-	-	-
141	920397	jK	64	F	26-Mar	NEPHRO WARD	Salmonella Typhi	CKD	-	-	-	-	YES	-
142	153906	HS	86	M	26-Mar	HDHI	Pseudomonas aeruginosa	AF WITH ACUTE CVA	YES	YES	-	YES	-	-
143	158446	R	34	F	28-Mar	GASTRO	Ecoli	PAIN ABD	-	-	-	-	-	-
144	907929	J	62	M	28-Mar	HDHI	Ecoli	AFI, SEVER MR, LVF, AKI, UTI	-	YES	-	YES	-	-
145	920782	BK	59	M	30-Mar	UROLOGY	Ecoli	PROSTATIC ABSCESS	-	-	-	-	-	-
146	907195	KK	11	F	31-Mar	ONCO	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
147	920347	G	28	M	1-Apr	NEUROLOGY WARD	Acinetobacter baumannii	TUBERCULAR MENINGITIS	-	-	-	-	-	YES
148	920980	LS	53	M	1-Apr	NEPHRO WARD	Ecoli	HYPOGLYCAEMIA, ACUTE ON CKD	-	-	-	-	YES	-
149	919270	NS	2	M	2-Apr	B-ICU	Klebsiella pneumoniae	SCALD BURN	-	-	-	-	-	-
150	895036	BS	65	M	3-Apr	ONC	Klebsiella pneumoniae	CARCINOMA	-	-	-	-	-	-
151	920436	RK	60	M	4-Apr	PCCU	Ecoli	EMPHYSEMA	-	-	-	-	-	-
152	891945	RK	60	M	7-Apr	GASTRO	Klebsiella pneumoniae	ACUTE PANCREATITIS	-	-	-	-	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																										RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
			MDR / XDR /PDR		AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
77	898912	-	MDR	R	S	R	R	R	S	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
78	22744	-	-	-	-	-	S	-	-	-	-	-	-	M	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
79	797648	-	MDR	R	S	R	R	S	S	R	R	-	R	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	<2	I	DIS	-
80	897833	-	MDR	R	S	S	R	R	R	R	R	-	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
81	828614	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
82	334696	-	MDR	S	S	S	R	S	R	R	S	-	S	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	DIS	-
83	901582	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
84	902214	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
85	900526	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
86	563493	YES	XDR	R	S	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	<2	I	DIS	-
87	715800	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
88	904268	-	-	R	S	S	S	S	S	S	R	-	R	S	-	-	-	S	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	8
89	885310	-	XDR	R	R	S	R	R	R	R	R	-	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
90	901534	-	XDR	R	S	R	R	R	R	R	R	-	R	R	R	S	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	65
91	906507	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	17
92	890489	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
93	902907	-	MDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	S	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	15
94	182908	-	-	R	S	S	S	S	S	S	R	-	R	S	-	-	-	S	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DAMA	6
95	910265	-	MDR	S	S	R	R	S	R	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	10
96	646565	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	4
97	448467	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	12
98	911671	-	MDR	S	S	R	S	S	S	MS	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	4
99	911667	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
100	901354	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	18
101	908588	-	MDR	R	S	S	R	R	R	R	R	-	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	25
102	912694	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
103	891780	-	MDR	R	S	S	R	S	S	MS	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
104	885606	-	-	S	S	S	S	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
105	913431	-	-	S	S	S	R	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
106	272224	-	XDR	R	S	R	R	R	R	M	-	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
107	914757	-	MDR	R	R	S	R	S	S	MS	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
108	914646	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	R	S	S	-	-	-	DIS	-
109	237135	-	MDR	S	S	R	R	R	R	R	S	-	S	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	-
110	907865	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	16
111	915955	YES	MDR	S	S	R	R	R	R	S	-	S	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
112	702308	-	XDR	R	R	R	R	R	R	M	-	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	4
113	909336	-	-	S	S	S	S	S	S	S	S	-	S	R	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
114	688271	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	12
115	915071	-	-	S	S	S	S	S	S	s	S	-	S	S	S	R	S	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
116	915583	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
117	165207	-	MDR	R	R	R	R	S	S	MS	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
118	917931	YES	-	S	S	S	S	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	-
119	368859	YES	MDR	R	R	R	S	R	R	R	R	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
120	158810	-	-	S	S	S	R	S	S	R	S	-	S	S	S	R	-	-	-	-	S	R	S	-	-	-	-	-	-	-	-	-	DIS	-
121	902893	-	-	S	R	R	R	R	R	R	S	-	S	MS	R	R	-	-	-	-	R	R	R	-	-	-	-	-	-	S	-	-	DIS	-
122	909443	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
123	918372	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	6
124	917494	-	MDR	S	S	R	R	S	S	S	S	-	S	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	LAMA	6
125	774837	-	-	S	S	S	R	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	EXP	2
126	917931	-	-	S	S	S	S	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	-
127	919227	-	-	R	R	R	S	R	R	R	R	-	R	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DAMA	2
128	918741	-	-	S	R	R	S	R	R	S	S	-	S	R	R	S	-	-	-	-	S	R	R	-	-	-	-	-	-	-	-	-	DIS	-
129	918489	-	-	S	R	R	S	R	R	R	S	-	S	R	R	S	-	-	-	-	S	R	R	-	-	-	-	-	-	-	-	-	DIS	-
130	919270	-	MDR	S	S	S	S	R	MS	S	S	-	S	S	MS	R	-	-	-	-	R	MS	R	-	-	-	-	-	-	S	-	-	DIS	20
131	919443	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	11
132	914758	-	XDR	R	R	R	R	MS	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	17
133	911052	-	-	S	S	S	S	S	s	S	S	-	S	S	S	R	S	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
134	920006	-	-	-	-	-	S	-	-	-	-	-	-	MS	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
135	919305	-	-	S	R	R	R	R	R	R	S	-	S	MS	R	R	-	-	-	-	MS	MS	-	-	-	-	-	-	-	-	-	-	DIS	-
136	60425	-	MDR	S	S	S	S	MS	R	S	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
137	920076	-	MDR	S	S	R	R	S	S	R	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
138	920188	-	MDR	S	R	R	S	R	R	R	S	-	S	R	R	S	-	-	-	-	S	R	R	-	-	-	-	-	-	-	-	-	DIS	-
139	886543	-	-	S	R	R	R	MS	R	R	S	-	S	R	R	R	-	-	-	-	R	R	MS	-	-	-	-	-	-	-	-	-	DIS	-
140	866714	-	-	S	S	S	S	S	s	S	S	-	S	S	R	R	S	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
141	920397	-	-	-	-	-	S	-	-	-	-	-	-	MS	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
142	153906	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
143	158446	-	MDR	S	R	S	S	R	R	R	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	3
144	907929	-	MDR	R	S	R	R	S	S	S	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
145	920782	-	MDR	R	S	R	R	S	S	S	R	-	R	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	<2	I	DIS	-
146	907195	YES	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
147	920347	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
148	920980	-	MDR	S	S	R	S	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
149	919270	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	20
150	895036	YES	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	6
151	920436	-	MDR	R	S	S	S	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	4
152	891945	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	8

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS						
		NAME	Age	Sex					DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
153	921766	JH	56	M	10-Apr	HDHI	Klebsiella pneumoniae	SEPSIS, ANAEMIA, CVA	YES	YES	-	YES	-	-
154	844105	HS	7m	M	11-Apr	P-ICU	Klebsiella pneumoniae	CKD, SEIZURE	-	-	-	-	YES	-
155	638536	RK	65	M	11-Apr	PCCU	Elizabethkingia	RESPIRATORY FAILURE	-	-	-	-	-	-
156	844403	LS	13	M	11-Apr	ONCO	Achromobacter xylosans	ALL	-	-	-	-	-	-
157	922018	RR	30	M	12-Mar	SURGERY WARD	Ecoli	LAPROTOMY	-	-	-	-	-	-
158	920059	BK	72	F	13-Apr	HDHI	Klebsiella pneumoniae	CVA	YES	YES	-	YES	-	-
159	190060	RK	35	F	12-Apr	GYNAECOLOGY WARD	Achromobacter xylosans	POST CAESARIAN MR, MS, MOD AR	-	-	-	YES	-	-
160	922225	CS	19	M	13-Apr	MEDICINE WARD	Salmonella typhi	AFI	-	-	-	-	-	-
161	922250	K	5	M	14-Apr	PAEDIATRIC WARD	Salmonella typhi	ENTERIC FEVER, HEPATITIS	-	-	-	-	-	-
162	169728	H	57	M	14-Apr	MEDICINE WARD	Ecoli	BREATHLESSNESS, COVID NEGATIVE	-	YES	-	-	-	-
163	922326	SS	58	M	15-Apr	GASTRO	Stenotrophomonas maltophilia	CIRRHOSIS WITH PORTAL HTN	-	-	-	-	-	-
164	922496	RK	34	M	16-Apr	GASTRO	Salmonella typhi	PANCREATITS	-	-	-	-	-	-
165	922603	DK	9	M	16-Apr	PAEDIATRIC WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
166	922510	S	60	F	15-Apr	MEDICINE WARD	Sphingomonas	FEVER, BREATHLESSNESS	-	-	-	-	-	-
167	911711	VK	66	M	17-Apr	NEPHRO WARD	Pseudomonas aeruginosa	CKD	YES	YES	-	-	YES	-
168	905116	RB	10	M	20-Apr	ONCO	Enterobacter cloacae complex	ALL	-	-	-	-	-	-
169	843672	D	4	M	20-Apr	ONCO	Pseudomonas aeruginosa	ALL	-	-	-	-	-	-
170	886543	PK	57	F	21-Apr	MEDICINE WARD	Enterobacter cloacae complex	ANT. WALL MI	YES	-	-	YES	-	-
171	923219	NB	53	F	21-Apr	NEPHRO WARD	Acinetobacter baumannii	AKI	-	-	-	-	-	-
172	898946	KS	60	M	22-Apr	NEPHRO WARD	Klebsiella pneumoniae	UTI, CKD	-	-	-	-	YES	-
173	921252	VS	27	M	22-Apr	SURGERY WARD	Klebsiella pneumoniae	PANCREATIC NECROSECTOMY	-	-	-	-	-	-
174	920647	BL	66	M	23-Apr	GASTRO	Citrobacter koseri	CIRRHOSIS	-	-	-	-	-	-
175	353201	S	67	F	25-Apr	ONCO	Ecoli	CA OVARY	-	-	-	-	-	-
176	920059	BK	72	F	26-Apr	ONCO	Klebsiella pneumoniae	CA BREAST	YES	-	-	-	-	-
177	922052	BJA	15D	F	26-Apr	P-ICU	Burkholderia cepacia	PRETEREM, SEPSIS	-	-	-	-	-	-
178	921055	SS	65	F	27-Apr	NEPHRO WARD	Ecoli	SEPSIS, CKD, SHOCK	-	-	-	-	YES	-
179	735069	BN	11m	M	28-Apr	PAEDIATRIC WARD	Salmonella typhi	ENTERIC FEVER	-	-	-	-	-	-
180	916012	SS	53	M	28-Apr	MEDICINE WARD	Ecoli	FEVER, BREATHING DIFFICULTY	-	-	-	-	-	-
181	923851	ap	73	m	5-May	PCCU	Pseudomonas aeruginosa	CA LIVER	-	-	-	-	-	-
182	924891	ks	72	f	4-May	HDU	Ecoli	PROSTATIC CANCER	-	-	-	-	-	-
183	813835	cs	23	m	4-May	EMG	Ecoli	DVT	YES	-	-	-	-	-
184	874644	ak	54	f	5-May	ONCO	Ecoli	LIVER CANCER	-	-	-	-	-	-
185	857851	sc	78	f	6-May	HDHI	Ecoli	CLD, AKI	-	-	-	-	-	-
186	925332	pj	8	f	6-May	EMG	Ecoli	NEPHRITIS	-	-	-	-	-	-
187	23681	gs	2m	m	6-May	P-ICU	Ecoli	PRETERM, SEPSIS ON VENTI	-	-	-	-	-	-
188	867137	RR	85	F	6-May	M-ICU	Pseudomonas aeruginosa	CKD	YES	-	-	-	YES	-
189	200340	VK	69	M	7-May	EMG	Ecoli	ALD	-	-	-	-	-	-
190	925550	BR	5D	M	8-May	NS-ICU	Ecoli	MENINGITIS	-	-	-	-	-	YES
191	921266	TR	47	M	8-May	GASTRO SURGERY	Ecoli	CIRRHOSIS	-	-	-	-	-	-
192	594151	KM	52	M	9-May	GASTRO WARD	Ecoli	PANCREATIC CA	-	-	-	-	-	-
193	923209	PK	52	F	9-May	HDHI	Klebsiella pneumoniae	ACUTE HEPATITIS	-	-	-	-	-	-
194	924023	MK	39	M	9-May	EMG	Klebsiella pneumoniae	ALD	YES	-	-	-	-	-
195	925900	MS	65	M	9-May	M-ICU	Klebsiella pneumoniae	MCA PCA INFARCT	YES	YES	-	-	-	YES
196	913010	pk	90	F	9-May	HDU	Ecoli	CKD	-	-	-	-	-	-
197	925964	g	1	m	10-May	NS-ICU	Pseudomonas aeruginosa	MENINGITIS	-	-	-	-	-	YES
198	924495	S	58	m	10-May	G-ICU	Acinetobacter baumannii	LIVER INJURY	-	-	-	-	-	-
199	925109	SD	65	F	10-May	EMG	Ecoli	CIRRHOSIS	YES	-	-	-	-	-
200	922020	RS	27	M	10-May	M-ICU	Acinetobacter baumannii	LEPTOSPIROSIS	-	-	-	-	-	-
201	926182	RD	50	F	12-May	G-ICU	Ecoli	LEPTOSPIROSIS	YES	-	-	-	-	-
202	925535	v	16	f	13-May	S-ICU	Acinetobacter baumannii	DVT, SEPSIS	-	-	-	-	-	-
203	919270	NS	2	M	13-May	NS-ICU	Acinetobacter lwoffii	HEPATITIS C	-	-	-	-	-	-
204	925636	C	27	F	13-May	HDU	Ecoli	SEPSIS	-	-	-	-	-	-
205	926551	CS	58	M	13-May	M-ICU	Ecoli	HYPERTHYROIDISM,MI	-	YES	-	YES	-	-
206	715264	DR	76	M	14-May	MEDICINE WARD	Ecoli	PANCYTOPENIA	-	-	-	-	-	-
207	926205	PK	70	F	14-May	M-ICU	Ecoli	SEPSIS	-	-	-	-	-	-
208	927114	BK	80	F	16-May	HDHI	Ecoli	CIRRHOSIS	-	-	-	-	-	-
209	877360	R	48	M	18-May	EMG	Ecoli	ALD	YES	-	-	-	-	-
210	909538	IS	29	M	18-May	HDU	Ecoli	NEPHRITIS	-	-	-	-	-	-
211	922500	BS	55	M	20-May	EMG	Klebsiella pneumoniae	PROTEINURIA	YES	-	-	-	-	-
212	927724	KK	48	M	20-May	MEDICINE WARD	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
213	923885	SS	36	M	22-May	PLASTIC SURGERY	Klebsiella pneumoniae	ALD	YES	-	-	-	-	-
214	911017	HS	75	M	24-May	PCCU	Klebsiella pneumoniae	ROAD SIDE ACCIDENT, SEPSIS,IVH, SAH,LRTI	-	-	-	-	-	-
215	892506	SK	65	M	24-May	ONCO	Klebsiella pneumoniae	CARCINOMA	YES	-	-	-	-	-
216	868993	VJ	14	M	25-May	NS-ICU	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
217	901497	VK	61	M	26-May	ANAES	Acinetobacter baumannii	BRACHETHERAPY	-	-	-	-	-	-
218	927113	NK	62	M	26-May	EMG	Acinetobacter baumannii	ALD	-	-	-	-	-	-
219	929298	JK	55	F	27-May	EMG	Ecoli	PANCYTOPENIA	-	-	-	-	-	-
220	924668	AJ	48	F	26-May	HDHI	Ecoli	FATTY LIVER	YES	-	-	-	-	-
221	770586	gk	3	f	26-May	PAED	Pseudomonas aeruginosa	ALL	-	-	-	-	-	-
222	930296	ss	50	m	30-May	G-ICU	Acinetobacter baumannii	ALD	-	-	-	-	-	-
223	734113	sk	58	m	31-May	EMG	Klebsiella pneumoniae	AKD	YES	-	-	-	-	-
224	930508	gk	45	f	31-May	EMG	Ecoli	PANCYTOPENIA	YES	-	-	-	-	-
225	930504	sd	55	f	1-Jun	EMG	Ecoli	MI	YES	-	-	YES	-	-
226	931554	b	73	M	3-Jun	EMG	Ecoli	BSI	YES	-	-	-	-	-
227	931608	BB	24	F	3-Jun	P-ICU	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
228	929045	BG	66	F	3-Jun	HDHI	Ecoli	VTE	-	-	-	-	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																											RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
			MDR / XDR /PDR		AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
153	921766	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
154	844105	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	8
155	638536	-	-	S	R	R	S	R	R	R	S	-	R	R	R	S	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	DIS	6
156	844403	YES	-	S	S	S	R	S	S	R	S	-	S	S	S	S	-	-	-	-	S	S	S	-	-	-	-	-	-	-	-	-	DIS	-
157	922018	-	MDR	S	S	R	R	S	S	R	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
158	920059	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
159	190060	-	MDR	S	R	R	R	S	R	R	S	-	S	R	R	S	-	-	-	-	R	S	R	-	-	-	-	-	-	-	-	-	DIS	-
160	922225	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
161	922250	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
162	169728	-	MDR	R	S	S	R	S	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
163	922326	-	-	S	R	R	R	R	R	R	S	-	S	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	DIS	-
164	922496	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
165	922603	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
166	922510	-	-	S	R	R	R	R	R	R	S	-	S	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	DIS	-
167	911711	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	1
168	905116	YES	MDR	S	S	S	R	S	S	R	S	-	S	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
169	843672	YES	-	S	S	S	S	S	S	S	S	-	S	R	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
170	886543	-	MDR	R	S	S	S	R	R	R	M	-	R	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
171	923219	-	XDR	R	R	R	R	M	R	R	R	-	R	R	R	R	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	-
172	898946	-	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
173	921252	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
174	920647	-	-	S	S	S	S	S	S	S	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	DIS	-
175	353201	YES	MDR	R	S	R	S	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
176	920059	YES	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
177	922052	-	MDR	S	R	R	S	R	R	R	S	-	R	R	R	S	-	-	-	-	M	R	-	-	-	-	-	-	-	-	-	-	DIS	15
178	921055	-	-	R	S	S	S	S	S	S	R	-	R	S	-	-	-	S	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DAMA	5
179	735069	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
180	916012	-	MDR	S	S	S	R	S	S	S	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	7
181	923851	YES	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	42
182	924891	YES	-	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	8
183	813835	-	MDR	S	S	S	R	R	R	S	S	-	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	-
184	874644	YES	MDR	S	S	S	R	R	R	R	S	-	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
185	857851	-	-	S	S	S	R	S	S	S	S	-	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
186	925332	-	'	S	S	S	S	S	S	S	S	-	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	4
187	23681	-	XDR	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	16
188	867137	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	8
189	200340	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	13
190	925550	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	1
191	921266	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
192	594151	YES	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
193	923209	-	XDR	R	R	R	R	R	R	R	R	M	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
194	924023	-	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
195	925900	-	PDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	4	R	DAMA	14
196	913010	-	MDR	S	S	S	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	14
197	925964	-	MDR	R	S	R	S	S	R	R	-	S	R	R	R	R	-	-	-	-	R	R	S	-	-	-	-	-	-	S	<2	I	DIS	5
198	924495	-	XDR	R	R	R	R	R	R	R	-	R	R	R	M	s	-	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	20
199	925109	-	MDR	R	S	R	S	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
200	922020	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	-	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	11
201	926182	-	MDR	S	S	S	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	12
202	925535	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	s	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	35
203	919270	-	-	S	S	S	R	S	S	S	S	-	S	R	R	R	s	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	15
204	925636	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	11
205	926551	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DAMA	3
206	715264	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	-
207	926205	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DAMA	10
208	927114	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
209	877360	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	-
210	909538	-	MDR	R	S	R	R	R	R	R	S	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	3
211	922500	-	MDR	S	S	R	R	R	R	R	S	M	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
212	927724	-	MDR	S	S	S	S	S	R	S	S	S	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	EXP	3
213	923885	-	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
214	911017	-	PDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	>8	R	LAMA	25
215	892506	YES	XDR	R	S	M	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
216	868993	YES	-	S	S	R	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	9
217	901497	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
218	927113	-	-	S	S	S	S	S	S	S	S	-	S	S	R	R	R	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
219	929298	-	MDR	S	S	S	R	R	R	S	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	6
220	924668	-	MDR	S	S	R	S	R	R	R	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
221	770586	YES	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	M	-	-	-	-	-	-	S	-	-	DIS	-
222	930296	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	LAMA	8
223	734113	-	XDR	R	R	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	8
224	930508	-	-	S	S	S	S	S	S	S	S	S	S	R	-	-	-	M	-	-	-	S	-	R	-	-	-	-	-	S	-	-	EXP	-
225	930504	-	MDR	S	S	R	R	S	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
226	931554	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
227	931608	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	12
228	929045	-	MDR	S	S	R	R	S	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS						
		NAME	Age	Sex					DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
229	932247	ak	47	F	5-Jun	M-ICU	Ecoli	MI, AKD	YES	-	-	YES	-	-
230	932265	rk	62	F	5-Jun	HDHI	Klebsiella ozanae	CKD	-	-	-	-	YES	-
231	834844	KD	53	F	8-Jun	G-ICU	Ecoli	BSI	-	-	-	-	-	-
232	362332	SK	6	M	9-Jun	S-ICU	Acinetobacter baumannii	FUNGEMIA, BSI	-	-	-	-	-	-
233	932579	SK	68	F	10-Jun	EMG	Klebsiella pneumoniae	HYPOPARATHYROIDISM, ALD	-	-	-	-	-	-
234	933440	BK	2D	M	10-Jun	P-ICU	Acinetobacter baumannii	JAUNDICE	-	-	-	-	-	-
235	934085	GS	2	M	12-Jun	EMG	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
236	934437	J	8	F	12-Jun	EMG	Klebsiella pneumoniae	HYPOTHYROIDISM	YES	-	-	-	-	-
237	934644	SR	62	F	14-Jun	M-ICU	Ecoli	BSI, AKD	YES	-	-	-	-	-
238	725970	MJ	73	M	15-Jun	M-ICU	Ecoli	FUNGEMIA, CLD, AKI	YES	-	-	-	-	-
239	153906	HS	86	M	15-Jun	STR-ICU	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
240	935122	JR	34	M	16-Jun	NEPHRO WARD	Klebsiella pneumoniae	NEPHRITIS	YES	-	-	-	-	-
241	935860	AS	4M	M	18-Jun	PAED	Ecoli	BSI	-	-	-	-	-	-
242	936105	PS	63	M	19-Jun	EMG	Klebsiella pneumoniae	CLD	YES	-	-	-	-	-
243	934699	TR	62/M	M	20-Jun	NS-ICU	Acinetobacter baumannii	EVD	-	-	-	-	-	YES
244	933092	VK	16	M	20-Jun	HDU	Klebsiella pneumoniae	FUNGEMIA, VTE	-	-	-	-	-	-
245	936418	MV	43	M	22-Jun	EMG	Ecoli	FUNGEMIA, VTE	YES	-	-	-	-	-
246	933916	k	65	f	22-Jun	EICU	Acinetobacter baumannii	ALD	-	-	-	-	-	-
247	937081	gk	56	f	24-Jun	EMG	Ecoli	FUNGEMIA, AKD	YES	-	-	-	-	-
248	932660	ns	58	M	24-Jun	STR-ICU	Ecoli	CLD	-	-	-	-	-	-
249	678831	AS	70	M	24-Jun	DIALYSIS	Ecoli	DIALYSIS	YES	-	-	-	YES	-
250	934418	HS	25	M	25-Jun	M-ICU	Ecoli	FUNGEMIA, AHD	-	-	-	-	-	-
251	797648	BK	63	F	25-Jun	HDU	Ecoli	CKD	-	-	-	-	YES	-
252	938278	rk	44	M	27-Jun	EMG	Ecoli	ALD	YES	-	-	-	-	-
253	938376	AK	71	F	28-Jun	G-ICU	Acinetobacter baumannii	COVID+, BED SORE	-	-	-	-	-	-
254	938399	GS	66	M	29-Jun	HDU	Ecoli	ALD	YES	-	-	-	-	-
255	937644	RS	19	M	29-Jun	B-ICU	Klebsiella pneumoniae	FUNGEMIA	-	-	-	-	-	-
256	899774	S	79	F	30-Jun	PCCU	Klebsiella pneumoniae	CHD	YES	YES	-	-	-	-
257	936763	MR	52	M	1-Jul	SKIN	Acinetobacter baumannii	FUNGEMIA	-	-	-	-	-	-
258	937669	J	21	M	2-Jul	EMG	Ecoli	FUNGEMIA	YES	-	-	-	-	-
259	815207	SG	74	M	2-Jul	ONCO	Ecoli	AKD	-	-	-	-	-	-
260	935269	S	5	F	2-Jul	PAED	Ecoli	ALL	-	-	-	-	-	-
261	906606	JS	60	M	3-Jul	DIALYSIS	Citrobacter koseri	HEPATITIS C	-	-	-	-	-	-
262	939385	BM	2D	F	3-Jul	P-ICU	Enterobacter cloacae complex	PRETERM, SEPSIS ON VENTI	-	-	-	-	-	-
263	932579	SK	67	F	3-Jul	MEDICINE WARD	Klebsiella pneumoniae	AKD	YES	-	-	-	-	-
264	939363	SG	62	F	4-Jul	EMG	Ecoli	COLON CANCER	YES	-	-	-	-	-
265	937081	GK	56	F	4-Jul	EMG	Ecoli	AKD	YES	-	-	-	-	-
266	940273	RL	60	M	5-Jul	EMG	Ecoli	CHD	-	YES	-	-	-	-
267	939797	RK	52	M	5-Jul	EICU	Klebsiella pneumoniae	VTE	-	-	-	-	-	-
268	938768	AS	65	M	6-Jul	EICU	Ecoli	BSI	YES	-	-	-	-	-
269	934691	BS	51	M	6-Jul	NS-ICU	Pseudomonas aeruginosa	MENINGITIS	-	-	-	-	-	YES
270	451879	PK	55	F	7-Jul	HDU	Klebsiella pneumoniae	MENINGITIS	-	-	-	-	YES	-
271	941032	RS	55	M	7-Jul	EMG	Klebsiella pneumoniae	AKD	YES	-	-	-	-	-
272	927113	NK	62	M	8-Jul	FW	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
273	941119	BS	50	M	8-Jul	EMG	Acinetobacter baumannii	ALD	-	YES	-	-	-	-
274	941155	A	55	F	8-Jul	EMG	Ecoli	MI	-	-	-	-	-	-
275	731032	AR	52	F	8-Jul	DIALYSIS	Acinetobacter baumannii	CKD	-	-	-	-	YES	-
276	930599	GR	69	M	8-Jul	T-ICU	Pseudomonas aeruginosa	MULTIPLE TRAUMA, RENAL TRANSPLANT	-	-	-	-	-	-
277	941473	RK	63	F	9-Jul	EMG	Ecoli	ALD	YES	-	-	-	-	-
278	587944	NV	36	F	9-Jul	PCCU	Klebsiella pneumoniae	BONE MARROW TRANSPLANTATION	-	-	-	-	-	-
279	937082	KG	15	M	10-Jul	NS-ICU	Klebsiella pneumoniae	ATYPICAL CELLS, SEPSIS	-	-	-	-	-	-
280	941141	SS	42	M	10-Jul	LIVER CARE	Citrobacter koseri	LIVER TRANSPLANT	-	-	-	-	-	-
281	942196	VK	62	M	11-Jul	MEDICINE WARD	Klebsiella pneumoniae	AKI	-	-	-	-	-	-
282	940840	BJ	6D	M	11-Jul	P-ICU	Klebsiella pneumoniae	NENATAL HEPATITIS	-	-	-	-	-	-
283	939797	RK	52	M	11-Jul	E-ICU	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
284	4029	UR	59	F	11-Jul	ONCO	Ecoli	CARCINOMA	-	-	-	-	-	-
285	924163	P	2	M	12-Jul	PAED	Ecoli	LEUKEMIA	-	-	-	-	-	-
286	806124	R	16	F	13-Jul	ONCO	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
287	940958	AJ	61	M	14-Jul	NS-ICU	Ecoli	MENINGITIS	-	-	-	-	-	YES
288	922983	MD	34	F	16-Jul	ONCO	Klebsiella pneumoniae	CARCINOMA	-	-	-	-	-	-
289	943767	KS	45	M	17-Jul	HDHI	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
290	941160	PK	32	M	18-Jul	PCCU	Acinetobacter baumannii	HEPATITIS C	-	-	-	-	-	-
291	944996	MK	37	F	19-Jul	NEPHRO WARD	Ecoli	NEPHRITIS	-	-	-	-	-	-
292	938879	RK	52	M	19-Jul	SICU	Klebsiella pneumoniae	CIRRHOSIS	-	-	-	-	-	-
293	920093	SK	23	M	20-Jul	ONCO	Acinetobacter baumannii	ALL	-	-	-	-	-	-
294	13638	R	48	F	23-Jul	GASTRO	Enterobacter cloacae complex	ALD	-	-	-	-	-	-
295	945391	MS	23	M	23-Jul	PCCU	Acinetobacter baumannii	MI, LIVER INJURY	-	YES	-	YES	-	-
296	944668	BMK	7D	F	24-Jul	P-ICU	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
297	947534	BS	75	M	27-Jul	EMG	Acinetobacter baumannii	DVT, MI	-	YES	-	YES	-	-
298	923559	S	2	M	28-Jul	P-ICU	Enterobacter cloacae complex	LEUKEMIA	-	-	-	-	-	-
299	906160	SS	57	M	28-Jul	PCCU	Klebsiella pneumoniae	CIRRHOSIS	YES	-	-	-	-	-
300	949458	JK	64	F	31-Jul	PCCU	Ecoli	DENGUE	-	-	-	-	-	-
301	905116	RB	10	M	31-Jul	P-ICU	Enterobacter cloacae complex	LEUKEMIA	-	-	-	-	-	-
302	931969	LD	57	F	1-Aug	ONCO	Acinetobacter baumannii	CARCINOMA	-	-	-	-	-	-
303	932592	KD	80	F	1-Aug	HDHI	Klebsiella pneumoniae	ANAEMIA,CKD,SEPSIS	-	-	-	-	YES	-
304	929313	SS	53	F	2-Aug	HDHI	Pseudomonas aeruginosa	ALD	YES	-	-	-	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																										RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
			MDR / XDR /PDR		AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
229	932247	-	MDR	S	S	R	R	S	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXPIRED	1
230	932265	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
231	834844	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	2
232	362332	-	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	LAMA	3
233	932579	-	XDR	R	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	5
234	933440	-	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	-	-	M	R	S	-	-	-	-	-	-	-	S	-	-	DIS	12
235	934085	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
236	934437	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
237	934644	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DAMA	4
238	725970	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DAMA	8
239	153906	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	8
240	935122	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
241	935860	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
242	936105	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
243	934699	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	19
244	933092	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	5
245	936418	-	MDR	S	S	R	S	R	R	S	S	S	S	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	-	-	EXP	-
246	933916	-	MDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	25
247	937081	-	MDR	R	R	R	R	R	R	R	S	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DAMA	16
248	932660	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	3
249	678831	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	6
250	934418	-	MDR	R	R	R	S	S	R	R	R	-	R	R	-	R	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXPIRED	7
251	797648	-	MDR	R	R	R	R	R	R	R	R	R	R	R	-	S	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	10
252	938278	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	-
253	938376	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	3
254	938399	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	1
255	937644	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	11
256	899774	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	7
257	936763	-	XDR	R	R	R	R	M	R	R	R	-	R	R	R	R	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	1
258	937669	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
259	815207	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DAMA	7
260	935269	YES	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
261	906606	-	-	S	S	S	S	S	S	S	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
262	939385	-	MDR	R	R	R	S	R	R	R	R	R	R	R	R	R	-	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	25
263	932579	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	5
264	939363	-	MDR	S	S	R	R	R	S	S	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
265	937081	-	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
266	940273	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
267	939797	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	33
268	938768	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	1
269	934691	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	LAMA	30
270	451879	-	XDR	R	M	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	17
271	941032	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
272	927113	-	MDR	R	S	S	R	R	R	R	R	R	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
273	941119	-	XDR	R	R	R	S	R	R	R	-	R	R	R	R	M	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
274	941155	-	MDR	S	S	R	R	R	S	S	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	3
275	731032	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
276	930599	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	14
277	941473	-	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
278	587944	YES	MDR	S	S	S	S	R	R	S	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	9
279	937082	-	XDR	R	R	R	R	R	R	R	S	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	5
280	941141	-	-	S	S	S	S	S	S	S	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
281	942196	-	MDR	S	S	S	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
282	940840	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	LAMA	5
283	939797	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	26
284	4029	YES	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
285	924163	YES	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
286	806124	YES	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
287	940958	-	MDR	S	S	R	R	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	18
288	922983	YES	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
289	943767	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
290	941160	-	XDR	R	R	R	S	R	R	R	-	R	R	R	R	R	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	2
291	944996	-	MDR	S	S	R	R	S	S	R	S	R	S	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
292	938879	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	2
293	920093	YES	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
294	13638	-	-	S	S	S	S	S	S	S	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
295	945391	-	MDR	R	R	R	S	S	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	19
296	944668	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	15
297	947534	-	MDR	R	R	R	R	R	R	S	S	-	R	R	R	S	R	-	-	-	S	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
298	923559	YES	-	S	S	S	S	S	S	S	S	S	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	8
299	906160	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	15
300	949458	-	MDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	3
301	905116	YES	-	S	S	S	S	S	S	S	S	S	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	30
302	931969	YES	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
303	932592	-	XDR	R	R	R	S	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
304	929313	-	MDR	R	R	R	R	R	R	R	R	-	R	R	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	<2	I	DIS	-

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS					
		NAME	Age	Sex					DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
305	944978	MK	35	F	3-Aug	STR-ICU	Klebsiella pneumoniae	STROKE, HYPOTHYROIDISM	-	YES	-	YES	-	-
306	937336	SB	50	F	3-Aug	M-ICU	Acinetobacter baumannii	ALD	YES	-	-	-	-	-
307	923559	SC	2	M	4-Aug	NS-ICU	Enterobacter cloacae complex	ALL	-	-	-	-	-	-
308	944941	BS	69	M	4-Aug	HDHI	Acinetobacter baumannii	MI, CKD	-	YES	-	YES	-	-
309	947360	VB	40	F	5-Aug	B-ICU	Klebsiella pneumoniae	THERMAL BURNS	YES	-	-	-	-	-
310	944593	HS	77	M	6-Aug	SURGERY WARD	Ecoli	PROSTATE CANCER, CHD	-	YES	-	YES	-	-
311	950166	K	59	M	10-Aug	EMG	Klebsiella pneumoniae	VTE	YES	-	-	-	-	-
312	953373	JS	15	M	11-Aug	HDU	Acinetobacter baumannii	SEPSIS, THROMBOSIS	-	-	-	-	-	-
313	953792	SK	73	M	12-Aug	EMG	Klebsiella pneumoniae	DIABETIC KETOACIDOSIS	YES	-	-	-	-	-
314	954175	SS	35	F	13-Aug	EMG	Klebsiella oxytoca	SESIS, ALD	-	-	-	-	-	-
315	952849	NK	38	F	13-Aug	T-ICU	Klebsiella pneumoniae	MULTIPLE TRAUMAS	YES	-	-	-	-	-
316	923848	DA	1	F	13-Aug	P-ICU	Klebsiella pneumoniae	THALASSEMIA	-	-	-	-	-	-
317	937374	LK	24	M	14-Aug	EMG	Klebsiella pneumoniae	TUBERCULOSIS	-	-	-	-	-	-
318	955226	DG	11	M	15-Aug	NS-ICU	Pseudomonas stutzeri	SEPTICAEMIA	-	-	-	-	-	-
319	955534	RS	59	M	16-Aug	PSYCHIATRY WARD	Acinetobacter baumannii	ALD, DRUG ADDICT	YES	-	-	-	-	-
320	953084	SK	40	M	17-Aug	EMG	Klebsiella pneumoniae	AKD	YES	-	-	-	-	-
321	943805	JK	8	F	17-Aug	P-ICU	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
322	946205	HL	51	M	18-Aug	EMG	Ecoli	HEPATITIS	YES	-	-	-	-	-
323	97060	bS	25D	M	18-Aug	P-ICU	Klebsiella pneumoniae	PRETERM, SEPSIS ON VENTI	-	-	-	-	-	-
324	956512	jr	55	M	19-Aug	EICU	Citrobacter koseri	CLD	-	-	-	-	-	-
325	937080	MS	47	M	19-Aug	PCCU	Pseudomonas aeruginosa	SEPTICAEMIA	-	-	-	-	-	-
326	957515	R	10	M	21-Aug	P-ICU	Ecoli	ALL	-	-	-	-	-	-
327	474792	sg	63	F	21-Aug	MEDICINE WARD	Ecoli	ALD	-	-	-	-	-	-
328	955323	SC	45	M	21-Aug	S-ICU	Klebsiella oxytoca	MI	-	-	-	YES	-	-
329	946602	BR	40	F	3-Sep	PLASTIC SURGERY	Pseudomonas aeruginosa	DIABETIC FOOT	YES	-	-	-	-	-
330	961989	KS	63	M	3-Sep	SURGERY WARD	Ecoli	DIABETIC FOOT	YES	-	-	-	-	-
331	961901	AK	20	M	7-Sep	ORTHO WARD	Pseudomonas aeruginosa	FEMUR FRACTURE	-	-	-	-	-	-
332	959888	AM	53	M	7-Sep	SURGERY WARD	Acinetobacter baumannii	AKD	-	-	-	-	-	-
333	963881	GS	55	M	9-Sep	HDU	Acinetobacter baumannii	LEPTOSPIROSIS, AKD	YES	-	-	-	-	-
334	955643	HG	55	M	9-Sep	M-ICU	Klebsiella pneumoniae	CKD, CIRRHOSIS	-	-	-	-	-	-
335	949991	DK	23	M	9-Sep	GASTRO	Klebsiella pneumoniae	DENGUE	-	-	-	-	-	-
336	962655	SS	62	F	10-Sep	ENDO	Pseudomonas aeruginosa	HYPERPARATHYROIDISM	YES	YES	-	-	-	-
337	963608	BN	4D	M	11-Sep	PAEDIATRIC WARD	Ecoli	LOWER GI BLEED	-	-	-	-	-	-
338	68337	GS	52	M	11-Sep	GASTRO	Ecoli	CIRRHOSIS	YES	-	-	-	-	-
339	294596	JR	67	M	11-Sep	HDHI	Ecoli	INFECTIVE ENDOCARDITIS	YES	YES	-	YES	-	-
340	964233	FA	35	M	12-Sep	PLASTIC SURGERY	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
341	903592	MS	75	M	13-Sep	PCCU	Klebsiella pneumoniae	VTE	-	-	-	-	-	-
342	952175	PC	10	F	14-Sep	PAEDIATRIC WARD	Klebsiella pneumoniae	FEVER, SEPSIS	-	-	-	-	-	-
343	517591	PS	42	M	15-Sep	PCCU	Acinetobacter baumannii	CLD	-	-	-	-	-	-
344	965966	SS	42	M	15-Sep	GASTRO	Acinetobacter baumannii	THROMBOCYTOPENIA	-	-	-	-	-	-
345	854487	M	28	M	16-Sep	CHEST	Acinetobacter baumannii	PYOGENIC ABSCESS	-	-	-	-	-	-
346	966366	P	22	F	17-Sep	HDHI	Ecoli	CHF	-	-	-	YES	-	-
347	961853	SG	37	M	17-Sep	SICU	Klebsiella pneumoniae	CLD	-	-	-	-	-	-
348	963108	SC	54	M	17-Sep	HDHI	Acinetobacter baumannii	EMBOLISM	-	-	-	-	-	-
349	764738	SS	63	M	18-Sep	SURGERY WARD	Ecoli	LAPROTOMY	-	-	-	-	-	-
350	528533	VR	67	F	18-Sep	HDHI	Klebsiella pneumoniae	AORTIC STENOSIS	-	-	-	YES	-	-
351	967455	RS	48	M	19-Sep	HDHI	Acinetobacter baumannii	AKI	-	-	-	-	-	-
352	935269	S	5	F	20-Sep	ONCOLOGY WARD	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
353	963049	AS	55	M	20-Sep	PCCU	Acinetobacter baumannii	VTE, AKI	-	-	-	-	-	-
354	967956	H	39	M	21-Sep	MEDICINE WARD	Ecoli	AFI	-	-	-	-	-	-
355	935243	GS	85	M	22-Sep	NEUROSURGERY ICU	Ecoli	ALCOHOLIC ENCEPHALOPATHY	-	-	-	-	-	-
356	968074	PC	63	M	22-Sep	EMERGENCY	Ecoli	CHF	-	-	-	YES	-	-
357	968436	DK	13	M	22-Sep	MEDICINE WARD	Enterobacter cloacae complex	DENGUE	-	-	-	-	-	-
358	969237	GK	23	M	25-Sep	GASTRO	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
359	825186	K	55	F	25-Sep	MEDICINE WARD	Klebsiella pneumoniae	PLEURAL EFFUSION	-	-	-	-	-	-
360	969265	NS	13	M	25-Sep	PICU	Ecoli	LIVER INJURY	-	-	-	-	-	-
361	969224	NG	52	F	26-Sep	PCCU	Klebsiella pneumoniae	VTE	-	-	-	-	-	-
362	374542	HS	59	M	26-Sep	HDHI	Ecoli	LV DYSFUNCTION	YES	-	-	-	-	-
363	969229	hs	63	M	27-Sep	SICU	Klebsiella pneumoniae	ARF	YES	-	-	-	-	-
364	621188	TS	63	M	28-Sep	SRR	Ecoli	ALD	YES	-	-	-	-	-
365	967948	BM	75	M	30-Sep	SRR	Ecoli	THROMBOSIS	YES	-	-	-	-	-
366	971225	WR	85	M	1-Oct	PCCU	Ecoli	BSI	YES	-	-	-	-	-
367	923848	DA	1	F	2-Oct	PCCU	Ecoli	HEPATOMA	-	-	-	-	-	-
368	969224	NG	52	F	2-Oct	PAEDIATRIC ONCO	Acinetobacter baumannii	CARCINOMA	-	-	-	-	-	-
369	893420	ML	75	M	2-Oct	GASTRO	Klebsiella pneumoniae	CKD	-	-	-	-	YES	-
370	970199	AK	3	F	4-Oct	PICU	Pseudomonas aeruginosa	SEPSIS	-	-	-	-	-	-
371	972154	SK	60	F	4-Oct	PCCU	Ecoli	HEPATITIS C	-	-	-	-	-	-
372	767099	AS	41	M	4-Oct	PCCU	Ecoli	HEPATITIS C, ANAEMIA	-	-	-	-	-	-
373	952175	pC	10	F	5-Oct	PAEDIATRIC ONCO	Enterobacter cloacae complex	ALL	-	-	-	-	-	-
374	973045	BS	38	M	7-Oct	EMERGENCY	Klebsiella pneumoniae	DENGUE	YES	-	-	-	-	-
375	973287	H	26	F	7-Oct	GYNAECOLOGY WARD	Enterobacter cloacae complex	GESTATIONAL DIABETES	YES	-	-	-	-	-
376	969733	AV	85	M	8-Oct	PCCU	Klebsiella pneumoniae	MI, CLD	YES	YES	-	YES	-	-
377	923848	DA	1	F	9-Oct	PAEDIATRIC ONCO	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
378	737588	Y	5	M	9-Oct	PAEDIATRIC ONCO	Klebsiella pneumoniae	ALL	-	-	-	-	-	-
379	960788	BS	52	M	10-Oct	NEUROSURGERY ICU	Klebsiella pneumoniae	LV DYSFUNCTION	-	-	-	YES	-	-
380	946438	AS	65	M	10-Oct	GASTRO ICU	Acinetobacter baumannii	CHOLESTASIS	-	-	-	-	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																										RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
			MDR / XDR /PDR		AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
305	944978	-	MDR	S	S	S	R	S	S	S	S	R	S	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	-	-	DIS	12
306	937336	-	MDR	R	R	R	R	R	R	R	R	R	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	24
307	923559	YES	-	S	S	S	S	S	S	S	S	S	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	9
308	944941	-	XDR	R	R	R	R	R	R	R	-	R	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
309	947360	-	MDR	S	S	S	R	S	S	R	S	R	S	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	-	-	DIS	30
310	944593	YES	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
311	950166	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
312	953373	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	EXP	2
313	953792	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DAMA	5
314	954175	-	MDR	S	S	S	R	R	R	R	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
315	952849	-	MDR	S	S	S	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	16
316	923848	YES	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	5
317	937374	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
318	955226	-	MDR	S	S	S	R	S	R	R	S	-	S	R	MS	R	-	-	-	S	R	S	-	-	-	-	-	-	-	S	-	-	DIS	15
319	955534	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
320	953084	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	LAMA	-
321	943805	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	26
322	946205	-	MDR	S	S	S	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	EXP	-
323	97060	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	9
324	956512	-	-	S	S	S	S	S	S	S	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	DIS	15
325	937080	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	26
326	957515	YES	MDR	R	S	S	S	R	R	S	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1
327	474792	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
328	955323	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	20
329	946602	-	MDR	R	S	S	R	S	S	R	R	-	R	R	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	<2	I	EXP	-
330	961989	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
331	961901	-	-	S	S	S	S	S	S	S	S	-	S	R	S	R	-	-	-	-	R	S	M	-	-	-	-	-	-	S	-	-	EXP	-
332	959888	-	XDR	R	R	R	R	R	R	R	-	R	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
333	963881	-	MDR	R	S	S	S	S	R	S	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	6
334	955643	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXPIRED	18
335	949991	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
336	962655	-	-	S	S	S	S	S	S	S	S	-	S	R	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	EXP	-
337	963608	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
338	68337	-	MDR	S	S	S	R	R	R	R	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
339	294596	-	MDR	S	S	R	R	S	S	S	S	S	S	R	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
340	964233	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
341	903592	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	4
342	952175	-	XDR	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	R	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
343	517591	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	9
344	965966	-	XDR	R	R	R	R	R	R	R	R	R	R	R	R	R	s	-	S	-	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	-
345	854487	-	-	S	S	S	R	S	R	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
346	966366	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
347	961853	-	MDR	R	S	R	R	R	R	S	S	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	7
348	963108	-	MDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
349	764738	-	-	S	S	S	R	S	S	S	S	S	S	R	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DAMA	11
350	528533	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
351	967455	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
352	935269	YES	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
353	963049	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	30
354	967956	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
355	935243	-	MDR	S	S	S	R	S	S	R	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	2
356	968074	-	MDR	S	S	S	R	S	S	R	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
357	968436	-	-	S	S	S	S	S	S	R	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
358	969237	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
359	825186	-	MDR	R	R	S	S	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
360	969265	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	5
361	969224	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	64
362	374542	-	MDR	S	S	S	S	S	S	R	S	S	S	R	-	-	-	R	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
363	969229	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	1
364	621188	-	MDR	S	S	R	S	S	S	R	S	S	S	R	-	-	-	M	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
365	967948	-	-	S	S	S	S	S	S	S	S	S	S	R	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
366	971225	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	53
367	923848	YES	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1
368	969224	YES	XDR	R	R	R	R	R	R	R	-	R	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
369	893420	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	-
370	970199	-	MDR	R	R	M	R	S	S	R	R	-	R	R	MS	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	<2	I	DIS	20
371	972154	-	MDR	S	S	S	S	R	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	14
372	767099	-	MDR	S	S	S	R	R	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	1
373	952175	YES	MDR	S	S	S	R	S	R	R	S	-	S	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
374	973045	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	-
375	973287	-	-	S	S	S	S	S	S	R	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	EXP	-
376	969733	-	MDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	13
377	923848	YES	XDR	R	R	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
378	737588	YES	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
379	960788	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	26
380	946438	-	XDR	R	R	M	R	R	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	6

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS	DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
		NAME	Age	Sex										
381	952603	PO	67	M	10-Oct	GASTRO ICU	Pseudomonas aeruginosa	AKI	YES	-	-	-	-	-
382	972028	AQ	45	M	10-Oct	MEDICINE WARD	Klebsiella pneumoniae	CHOLESTASIS	YES	-	-	-	-	-
383	965306	KL	73	M	11-Oct	MEDICINE WARD	Acinetobacter baumannii	VTE, AKI, CLD	-	-	-	-	-	-
384	737588	Y	5	M	12-Oct	PAEDIATRIC ONCO	Ecoli	ALL	-	-	-	-	-	-
385	963636	HS	8M	M	13-Oct	PAEDIATRIC ICU	Acinetobacter baumannii	SDH WITH RESP DISTRESS AND CRANIOTOMY	-	-	-	-	-	-
386	972058	MS	87	M	13-Oct	HDHI	Klebsiella oxytoca	MR, CKD	-	-	-	-	-	-
387	847339	J	60	M	15-Oct	HDHI	Klebsiella pneumoniae	SEPSIS, AKI	-	-	-	-	-	-
388	911571	P	58	M	16-Oct	DUMRA ISOL	Acinetobacter baumannii	COVID+, BED SORE	YES	-	-	-	-	-
389	972029	KD	73	F	16-Oct	M-ICU	Klebsiella pneumoniae	POST SEVERE COVID PNEUMONITIS, ON MECH. VENTILATOR, FUNGAL SEPSIS, VAP	-	YES	-	-	-	-
390	975901	BS	50	M	16-Oct	GASTRO	Ecoli	HEPATITIS C, CLD, JAUNDICE	-	-	-	-	-	-
391	976779	SD	63	F	16-Oct	M-ICU	Klebsiella pneumoniae	ARF	-	-	-	-	-	-
392	847339	JK	60	M	17-Oct	M-ICU	Klebsiella pneumoniae	MI,AKI, SEPSIS	-	-	-	-	-	-
393	920839	DK	54	F	18-Oct	ONCOLOGY WARD	Enterobacter cloacae complex	CANCER	-	-	-	-	-	-
394	425055	SK	59	M	18-Oct	HDHI	Klebsiella pneumoniae	CHR. HEART DS	-	YES	-	YES	-	-
395	977187	BD	60	M	18-Oct	SURGERY WARD	Klebsiella pneumoniae	EXP. LAPROTOMY WITH BOWEL RESECTION	-	-	-	-	-	-
396	974449	SS	33	M	18-Oct	HDHI	Klebsiella pneumoniae	DENGUE	-	YES	-	-	-	-
397	976628	SS	42	M	19-Oct	MEDICINE WARD	Ecoli	DVT	YES	-	-	-	-	-
398	828128	KS	85	M	19-Oct	MEDICINE WARD	Klebsiella pneumoniae	ANAEMIA, AF,B/L LL CELLULITIS	-	-	-	-	-	-
399	34461	AS	26	M	19-Oct	PAED ICU	Klebsiella pneumoniae	PUO	-	-	-	-	-	-
400	950245	RK	20	M	19-Oct	ONCOLOGY WARD	Acinetobacter baumannii	CANCER	-	-	-	-	-	-
401	791852	sk	31	M	21-Oct	UROLOFY WARD	Pseudomonas aeruginosa	CKD	-	-	-	-	YES	-
402	975997	BD	3	M	21-Oct	MEDICINE WARD	Klebsiella ozanae	ANAEMIA, CKD	-	YES	-	-	YES	-
403	978141	RD	43	F	22-Oct	PLASTIC SURGERY	Klebsiella pneumoniae	FLAME BURN(98%)	-	-	-	-	-	-
404	978143	NS	70	M	22-Oct	GASTRO WARD	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
405	979448	CR	70	M	24-Oct	NEPHRO WARD	Ecoli	CLD	-	-	-	-	-	-
406	979729	BS	53	M	25-Oct	GASTRO WARD	Klebsiella pneumoniae	MI	-	YES	-	YES	-	-
407	974117	R	50	M	25-Oct	HDHI	Klebsiella pneumoniae	MI	YES	YES	-	YES	-	-
408	978153	SS	24	M	26-Oct	NS-ICU	Acinetobacter baumannii	EVD	-	-	-	-	-	YES
409	764738	SS	63	M	26-Oct	DIALYSIS	Pseudomonas aeruginosa	CKD	YES	-	-	-	YES	-
410	980253	BK	50	F	26-Oct	HDU	Ecoli	CKD	-	-	-	-	YES	-
411	980261	PD	60	F	26-Oct	GASTRO WARD	Ecoli	AKI	-	-	-	-	-	-
412	980278	RK	34	M	27-Oct	GASTRO ICU	Acinetobacter baumannii	CHOLELETHIASIS	-	-	-	-	-	-
413	977730	KR	41	F	27-Oct	PCCU	Klebsiella pneumoniae	ALD	YES	-	-	-	-	-
414	975474	VS	31	M	27-Oct	NS-ICU	Acinetobacter baumannii	EVD	-	-	-	-	-	YES
415	980584	HK	60	F	27-Oct	DIALYSIS	Ecoli	CKD	YES	-	-	-	YES	-
416	977162	FC	73	M	28-Oct	MEDICINE WARD	Klebsiella pneumoniae	AKI	-	-	-	-	-	-
417	979839	RK	35	M	28-Oct	PLASTIC SURGERY	Ecoli	FLAME BURN	-	-	-	-	-	-
418	220961	KD	55	M	28-Oct	SICU	Klebsiella pneumoniae	AKI	-	-	-	-	-	-
419	979815	SK	40	M	29-Oct	SURGERY WARD	Acinetobacter baumannii	EXP. LAPROTOMY WITH BOWEL RESECTION	-	-	-	-	-	-
420	977698	MS	32	M	29-Oct	SURGERY WARD	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
421	977324	AD	41	F	30-Oct	SURGERY WARD	Klebsiella pneumoniae	AKI	-	-	-	-	-	-
422	981856	NS	62	M	30-Oct	M-ICU	Ecoli	CLD	-	-	-	-	-	-
423	980747	AK	32	M	30-Oct	MEDICINE WARD	Pseudomonas aeruginosa	PLEURAL EFFUSION	-	-	-	-	-	-
424	981442	SG	70	M	30-Oct	SICU	Enterobacter cloacae complex	CKD	-	-	-	-	YES	-
425	938739	H	2	M	31-Oct	PAEDIATRIC WARD	Acinetobacter baumannii	SEPTICAEMIA	-	-	-	-	-	-
426	158810	SK	64	F	31-Oct	GASTRO WARD	Ecoli	ALD	YES	-	-	-	-	-
427	967332	DK	71	F	31-Oct	ONCOLOGY WARD	Klebsiella pneumoniae	CANCER	YES	-	-	-	-	-
428	977324	AD	41	F	1-Nov	M-ICU	Klebsiella pneumoniae	AKD	-	-	-	-	-	-
429	980281	LS	75	M	2-Nov	NEUROLOGY WARD	Ecoli	CKD	YES	-	-	-	YES	YES
430	975147	BS	17	M	2-Nov	SICU	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
431	893504	ML	68	M	2-Nov	DIALYSIS	Pseudomonas aeruginosa	CKD	-	-	-	-	YES	-
432	945584	RU	59	M	3-Nov	ONCOLOGY WARD	Enterobacter cloacae complex	CANCER	-	-	-	-	-	-
433	982302	SK	54	F	3-Nov	EICU	Sphingomonas	DVT	-	-	-	-	-	-
434	980211	HK	60	F	4-Nov	M-ICU	Acinetobacter baumannii	AKI	YES	-	-	-	-	-
435	978091	TS	57	M	4-Nov	ISOLATION	Klebsiella pneumoniae	COVID +, NEUTROPENIA	YES	-	-	-	-	-
436	975147	BS	17	M	4-Nov	SICU	Klebsiella pneumoniae	BOWEL OBSTRUCTION	-	-	-	-	-	-
437	887801	SJ	74	M	5-Nov	ONCOLOGY WARD	Klebsiella pneumoniae	CANCER	-	-	-	-	-	-
438	983778	BR	65	M	6-Nov	SURGERY WARD	Ecoli	EXP. LAPROTOMY WITH DI PERFORATION	-	-	-	-	-	-
439	435282	JD	60	F	6-Nov	NEPHRO WARD	Citrobacter koseri	AKD, AHD	-	YES	-	-	-	-
440	970092	JS	92	M	6-Nov	HDHI	Ecoli	CLD, CHD	-	-	-	YES	-	-
441	983511	PK	45	M	6-Nov	GASTRO	Acinetobacter baumannii	CIRRHOSIS	-	-	-	-	-	-
442	583514	BS	74	M	7-Nov	MEDICINE WARD	Klebsiella pneumoniae	PLEURAL EFFUSION	YES	-	-	-	-	-
443	983724	RL	65	M	8-Nov	NS-ICU	Klebsiella pneumoniae	MENINGITIS	-	-	-	-	-	-
444	980687	JS	50	M	9-Nov	MEDICINE WARD	Klebsiella pneumoniae	LOWER GI BLEED	-	-	-	-	-	-
445	651060	BJ	62	F	10-Nov	NEUROSURGERY WARD	Klebsiella pneumoniae	EVD	-	-	-	-	-	-
446	935265	J	14	M	10-Nov	PAED-ICU	Enterobacter CLoacae complex	ALL	-	-	-	-	-	-
447	983450	MK	52	M	10-Nov	PCCU	Acinetobacter baumannii	MI	-	YES	-	YES	-	-
448	983524	K	55	M	11-Nov	SICU	Ecoli	EXPLORATORY LAPROTOMY AND CA CAECUM AND ASC COLON	-	-	-	-	-	-
449	986089	KR	80	F	11-Nov	STR-ICU	Klebsiella pneumoniae	CHD	-	YES	-	YES	-	-
450	984232	SC	72	M	13-Nov	HDHI	Klebsiella pneumoniae	CKD	-	-	-	-	YES	-
451	985495	VR	60	M	13-Nov	ENT WARD	Ecoli	SEPSIS	YES	-	-	-	-	-
452	213430	SS	49	M	14-Nov	PCCU	Acinetobacter baumannii	CHRONIC ALCOHOLIC,SEPTIC ENCEPHALOPATHY, LEPTOSPIROSIS	YES	YES	-	-	-	YES
453	938739	H	1	M	14-Nov	PAEDIATRIC WARD	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
454	899170	RK	60	M	14-Nov	HDHI	Acinetobacter baumannii	MI, LIVER INJURY	YES	-	-	YES	-	-
455	916725	NS	35	M	15-Nov	GASTRO	Ecoli	ALD	-	-	-	-	-	-
456	987296	SS	30	M	16-Nov	STROKE	Ecoli	EMBOLISM, MI, ALD	-	-	-	YES	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																											RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
			MDR / XDR /PDR		AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
381	952603	-	XDR	R	R	R	R	S	R	R	R	-	R	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	4
382	972028	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
383	965306	-	XDR	R	R	R	R	M	R	R	R	-	R	R	R	R	R	-	S	M	R	R	-	-	-	-	-	-	-	S	<2	I	DAMA	10
384	737588	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
385	963636	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	6
386	972058	-	MDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	S	-	R	-	-	-	-	-	S	<2	I	DIS	-
387	847339	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
388	911571	-	XDR	R	R	R	R	M	R	R	R	-	R	R	R	R	R	-	S	M	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
389	972029	-	XDR	R	M	S	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	>8	R	DAMA	6
390	975901	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
391	976779	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DAMA	3
392	847339	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DAMA	6
393	920839	YES	-	S	S	S	S	S	S	R	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
394	425055	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
395	977187	-	MDR	S	S	S	S	S	S	R	S	S	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	-
396	974449	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
397	976628	-	MDR	S	S	R	S	S	S	M	S	-	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
398	828128	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
399	34461	-	-	S	S	S	R	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	8
400	950245	YES	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	13
401	791852	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	EXP	15
402	975997	-	XDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
403	978141	-	XDR	R	S	R	R	R	R	M	R	R	R	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	>8	R	EXP	5
404	978143	-	MDR	S	S	S	R	S	R	R	S	S	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
405	979448	-	XDR	R	R	R	R	R	R	R	M	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
406	979729	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
407	974117	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
408	978153	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	M	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	4
409	764738	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	S	-	-	-	-	-	-	S	-	-	DIS	-
410	980253	-	MDR	S	S	R	R	S	R	R	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	6
411	980261	-	MDR	S	S	S	S	R	R	S	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
412	980278	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	6
413	977730	-	XDR	R	R	R	S	R	R	R	R	R	M	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	2
414	975474	-	MDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	2
415	980584	-	MDR	S	S	R	S	S	S	S	S	S	S	R	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
416	977162	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	4
417	979839	-	MDR	S	R	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	EXP	-
418	220961	-	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	5
419	979815	-	XDR	R	R	R	S	R	R	R	R	-	R	R	R	R	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	LAMA	-
420	977698	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
421	977324	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	13
422	981856	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1
423	980747	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	M	-	-	-	-	-	-	S	-	-	DAMA	9
424	981442	-	-	S	S	S	S	S	S	R	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	LAMA	17
425	938739	-	-	S	S	S	S	S	R	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
426	158810	-	-	S	S	S	R	S	S	S	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
427	967332	YES	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
428	977324	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXPIRED	12
429	980281	-	MDR	S	S	S	R	S	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	-
430	975147	-	AK COL GEN-M	R	M	M	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	25
431	893504	-	-	S	S	S	S	S	S	S	S	-	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	4
432	945584	YES	-	S	S	S	S	S	R	S	S	-	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
433	982302	-	-	S	R	R	S	S	R	R	S	-	S	R	R	M	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	LAMA	12
434	980211	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXPIRED	3
435	978091	-	MDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
436	975147	-	XDR	R	S	M	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	23
437	887801	YES	XDR	R	R	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
438	983778	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
439	435282	-	AMPHO-S	S	R	R	R	R	R	R	S	-	S	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	DIS	-
440	970092	-	MDR	S	S	S	R	S	R	R	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
441	983511	-	-	S	R	S	S	S	S	S	S	-	R	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
442	583514	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
443	983724	-	-	S	S	S	S	S	S	R	S	S	S	S	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	-	-	DIS	10
444	980687	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	27
445	651060	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
446	935265	-	MDR	R	S	S	R	S	R	R	R	-	S	S	R	R	-	-	-	S	S	R	-	-	-	-	-	-	-	S	<2	I	DIS	5
447	983450	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	1
448	983524	-	XDR	R	M	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	3
449	986089	-	XDR	R	R	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	7
450	984232	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
451	985495	-	MDR	S	S	R	R	R	R	R	S	S	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
452	213430	-	MDR	R	R	R	R	S	R	R	R	-	R	S	R	S	R	-	-	-	S	R	-	-	-	-	-	-	-	S	>8	R	DIS	26
453	938739	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
454	899170	-	MDR	R	R	R	R	S	R	R	R	-	R	R	R	M	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
455	916725	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
456	987296	-	MDR	S	S	S	S	R	R	R	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	16

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS						
		NAME	Age	Sex					DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
457	987716	JS	58	M	17-Nov	HDU	Ecoli	ALD	-	-	-	-	-	-
458	974145	RA	22	M	17-Nov	ONCO	Ecoli	SEPSIS	-	-	-	-	-	-
459	144325	SG	78	M	17-Nov	HDHI	Pseudomonas aeruginosa	MI, EMBOLISM	-	-	-	YES	-	-
460	977690	GS	65	M	18-Nov	MEDICINE WARD	Ecoli	DENGUE	-	-	-	-	-	-
461	988273	MK	49	F	18-Nov	GASTRO	Ecoli	AKI	YES	-	-	-	-	-
462	987136	SB	56	F	18-Nov	NS-ICU	Acinetobacter baumannii	MI	YES	-	-	YES	-	-
463	981410	BKK	23D	M	20-Nov	P-ICU	Ecoli	MENINGOENCEPHALITIS	-	-	-	-	-	YES
464	948854	S	68	F	20-Nov	STR-ICU	Acinetobacter baumannii	CHF	-	-	-	YES	-	-
465	40905	SK	56	F	20-Nov	HDU	Ecoli	CHF	-	-	-	YES	-	-
466	989654	BS	45	M	20-Nov	MEDICINE WARD	Klebsiella pneumoniae	HEPATITIS C	YES	-	-	-	-	-
467	979181	BK	67	F	21-Nov	EYE	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
468	817131	MS	49	M	21-Nov	NEPHRO WARD	Enterobacter cloacae complex	AKI	YES	-	-	-	-	-
469	972635	PL	58	F	21-Nov	NEPHRO WARD	Ecoli	CKD	-	-	-	-	YES	-
470	982625	S	72	F	22-Nov	EICU	Acinetobacter baumannii	CHF	-	-	-	YES	-	-
471	986879	RS	57	F	23-Nov	HDHI	Acinetobacter baumannii	CKD, ALD	-	YES	-	-	-	-
472	608081	N	47	M	23-Nov	NEPHRO WARD	Acinetobacter baumannii	ASCITIS	-	-	-	-	-	-
473	990584	BR	55	M	23-Nov	UROLOFY WARD	Ecoli	SEPSIS	-	-	-	-	-	-
474	990350	AK	34	M	24-Nov	GASTRO	Ecoli	ASCITIS	-	-	-	-	-	-
475	988300	BR	8D	F	24-Nov	NS-ICU	Ecoli	ANAEMIA, SEPSIS	-	-	-	-	-	-
476	985319	NS	48	M	24-Nov	SURGERY WARD	Klebsiella pneumoniae	LAPROTOMY	-	-	-	-	-	-
477	988255	UR	62	F	24-Nov	HDU	Acinetobacter baumannii	SEPSIS, LOWER GI BLEED	-	-	-	-	-	-
478	991445	J	47	M	25-Nov	MEDICINE WARD	Ecoli	PANCREATIC NECROSIS	-	-	-	-	-	-
479	991688	JK	18	F	25-Nov	MEDICINE WARD	Salmonella typhi	FEVER	-	-	-	-	-	-
480	145828	SL	74	M	25-Nov	MEDICINE WARD	Acinetobacter baumannii	MI	-	-	-	YES	-	-
481	93483	RD	58	M	25-Nov	NEPHRO WARD	Acinetobacter baumannii	DENGUE	-	-	-	-	-	-
482	922983	MD	34	F	26-Nov	ONCOLOGY WARD	Klebsiella pneumoniae	CARCINOMA	-	-	-	-	-	-
483	729657	S	56	F	27-Nov	GASTRO	Ecoli	CHOLELITHIASIS	YES	-	-	-	-	-
484	991459	KS	71	M	27-Nov	MEDICINE WARD	Ecoli	CHOLESTASIS	-	-	-	-	-	-
485	992720	SA	2	M	27-Nov	P-ICU	Salmonella paratyphi A	AFI	-	-	-	-	-	-
486	922983	MD	34	F	28-Nov	ONCOLOGY WARD	Klebsiella pneumoniae	CARCINOMA	-	-	-	-	-	-
487	128302	CP	57	F	29-Nov	M-ICU	Acinetobacter baumannii	AKD, ALD	YES	YES	-	-	-	-
488	986887	C	59	M	29-Nov	HDHI	Klebsiella pneumoniae	PNEUMONIA, COVID+	YES	-	-	-	-	-
489	993395	PK	63	M	30-Nov	EICU	Acinetobacter baumannii	CKD, THROMBOSIS	-	-	-	-	YES	-
490	990970	RS	55	M	30-Nov	M-ICU	Acinetobacter baumannii	SCRUB TYPHUS	-	-	-	-	-	-
491	987258	PA	60	F	1-Dec	MEDICINE WARD	Acinetobacter baumannii	KETOACIDOSIS	YES	-	-	-	-	-
492	993817	PS	73	F	1-Dec	MEDICINE WARD	Ecoli	ALD	-	-	-	-	-	-
493	985794	GD	80	M	1-Dec	ORTHO WARD	Ecoli	SHOCK, HAEMMRHAGE	-	-	-	-	-	-
494	635154	HK	56	F	2-Dec	ENDO	Ecoli	CKD	-	-	-	-	YES	-
495	994621	VK	58	M	3-Dec	EMG	Proteus mirabilis	CIRRHOSIS	-	-	-	-	-	-
496	672998	HS	61	M	3-Dec	HDU	Ecoli	ELECTROLYTE IMBALANCE	-	-	-	-	-	-
497	189536	IS	59	M	3-Dec	EICU	Ecoli	CIRRHOSIS	-	-	-	-	-	-
498	975455	S	12	F	4-Dec	P-ICU	Klebsiella pneumoniae	SEIZURE,DENGUE	-	-	-	-	-	-
499	988999	BK	2	F	4-Dec	PAEDIATRIC WARD	Acinetobacter baumannii	SSSS	-	-	-	-	-	-
500	991920	BVK	9D	M	4-Dec	P-ICU	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
501	992290	A	46	F	5-Dec	ONCO	Ecoli	BSI	-	-	-	-	-	-
502	986946	DS	15	M	5-Dec	GASTRO	Klebsiella pneumoniae	RSA WITH BLUNT INJURY	-	-	-	-	-	-
503	978832	AB	16	M	5-Dec	PAEDIATRIC WARD	Pseudomonas stutzeri	SEPSIS	-	-	-	-	-	-
504	996230	DC	2	M	6-Dec	LIVER CARE	Salmonella typhi	LIVER TRANSPLANT	-	-	-	-	-	-
505	98434	JS	58	M	6-Dec	EMG	Klebsiella pneumoniae	ALD	-	-	-	-	-	-
506	748178	D	8	M	7-Dec	PAED	Salmonella typhi	AFI	-	-	-	-	-	-
507	995769	RS	53	M	7-Dec	S-ICU	Ecoli	IBD	-	-	-	-	-	-
508	996518	SS	73	F	8-Dec	EMG	Ecoli	BSI	-	-	-	-	-	-
509	986887	CK	59	M	8-Dec	HDHI	Acinetobacter baumannii	CLD, CHD	-	YES	-	YES	-	-
510	994631	US	32	M	10-Dec	SICU	Klebsiella pneumoniae	AKI	-	-	-	-	-	-
511	994631	US	32	M	10-Dec	SICU	Acinetobacter baumannii	PANCREATITIS	-	-	-	-	-	-
512	981434	G	55	M	10-Dec	D WARD	Klebsiella pneumoniae	CHD	-	YES	-	YES	-	-
513	997791	A	2	M	10-Dec	MEDICINE WARD	Salmonella typhi	AFI	-	-	-	-	-	-
514	987055	KK	55	F	12-Dec	B-ICU	Pseudomonas aeruginosa	THERMAL BURNS	-	-	-	-	-	-
515	999435	SS	58	M	13-Dec	PCCU	Ecoli	CHD	-	YES	-	YES	-	-
516	999567	BS	74	M	14-Dec	NEUROSURGERY WARD	Acinetobacter baumannii	MENINGITIS	-	-	-	-	-	YES
517	999577	BP	7D	M	14-Dec	PAED-ICU	Ecoli	LBW,PRETERM.SEPSIS	-	-	-	-	-	-
518	997340	SS	52	M	15-Dec	GASTRO WARD	Acinetobacter baumannii	ALD	-	-	-	-	-	-
519	1000511	MB	63	F	16-Dec	MEDICINE WARD	Klebsiella pneumoniae	DVT	-	-	-	-	-	-
520	988999	BK	2	F	17-Dec	PAEDIATRIC WARD	Klebsiella oxytoca	SEPSIS	-	-	-	-	-	-
521	936851	GS	17	M	18-Dec	MEDICINE WARD	Ecoli	AFI	-	-	-	-	-	-
522	963636	HS	10M	M	16-Dec	N-ICU	Klebsiella pneumoniae	SEPSIS, LBW	-	-	-	-	-	-
523	998058	PS	61	M	17-Dec	T-ICU	Enterobacter cloacae complex	MULTIPLE INJURIES, HCV + VE	-	-	-	-	-	-
524	925248	SK	13	F	18-Dec	ONCOLOGY WARD	Ecoli	CANCER	-	-	-	-	-	-
525	808357	TR	55	M	19-Dec	ONCOLOGY WARD	Ecoli	CANCER	-	-	-	-	-	-
526	1002524	GK	60	F	20-Dec	NEUROLOGY WARD	Enterobacter cloacae complex	AKI	YES	-	-	-	-	-
527	9968861	AP	11M	M	21-Dec	P-ICU	Klebsiella pneumoniae	SEPSIS, LBW	-	-	-	-	-	-
528	1001519	OJ	8M	M	21-Dec	PAED-ICU	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
529	1003064	JK	47	F	22-Dec	NEPHRO WARD	Ecoli	AKI	-	-	-	-	YES	-
530	1002664	KL	57	M	23-Dec	GASTRO WARD	Ecoli	PAIN ABDOMEN	-	-	-	-	-	-
531	975690	KS	58	M	23-Dec	ONCOLOGY WARD	Pseudomonas aeruginosa	CARCINOMA	-	-	-	-	-	-
532	6624	MK	10	F	23-Dec	MEDICINE WARD	Salmonella paratyphi A	AFI	-	-	-	-	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																										RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
			MDR / XDR /PDR		AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
457	987716	-	MDR	S	S	R	S	S	S	R	S	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	7
458	974145	-	MDR	S	S	R	S	R	R	R	S	R	S	R	-	-	-	R	-	R	-	R	-	R	-	-	-	-	-	S	-	-	EXP	-
459	144325	-	XDR	R	R	R	R	S	R	R	R	-	R	R	R	R	-	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
460	977690	-	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
461	988273	-	MDR	S	S	R	S	S	R	S	S	S	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
462	987136	-	XDR	R	R	R	R	R	R	R	R	-	M	R	R	R	R	-	S	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	37
463	981410	-	MDR	S	S	S	S	S	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	6
464	948854	-	-	S	S	S	S	S	R	S	S	-	S	M	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	EXP	1
465	40905	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	10
466	989654	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
467	979181	-	MDR	R	S	S	S	R	R	R	R	R	S	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
468	817131	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
469	972635	-	-	S	S	S	R	S	S	S	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
470	982625	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	M	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	7
471	986879	-	MDR	R	R	R	R	S	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
472	608081	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
473	990584	-	-	S	S	S	R	S	S	S	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
474	990350	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	LAMA	-
475	988300	-	MDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	50
476	985319	-	MDR	S	S	R	R	S	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
477	988255	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	M	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	DAMA	6
478	991445	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
479	991688	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	MS	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
480	145828	-	MDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
481	93483	-	MDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
482	922983	YES	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
483	729657	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
484	991459	-	-	S	S	S	R	S	S	S	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
485	992720	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	R	S	S	-	-	-	DIS	32
486	922983	YES	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	-
487	128302	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	DAMA	9
488	986887	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	S	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
489	993395	-	MDR	R	R	R	R	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	5
490	990970	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	8
491	987258	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	4
492	993817	-	MDR	S	S	S	R	S	R	R	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
493	985794	-	MDR	S	S	S	R	R	R	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	DIS	-
494	635154	-	-	S	S	S	R	S	S	S	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
495	994621	-	MDR	R	S	S	R	S	S	R	R	-	R	R	R	R	-	-	-	-	R	R	S	-	-	-	-	-	-	-	-	-	DIS	-
496	672998	-	MDR	S	R	R	S	R	R	S	S	S	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	EXP	4
497	189536	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1
498	975455	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	2
499	988999	-	-	S	S	S	S	S	S	S	S	S	S	R	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
500	991920	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1
501	992290	-	MDR	R	S	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
502	986946	-	-	S	S	S	S	S	S	S	S	S	S	S	-	S	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
503	978832	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
504	996230	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	S	-	-	DIS	-
505	98434	-	XDR	R	S	S	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
506	748178	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	S	-	-	DIS	-
507	995769	-	-	S	S	S	S	S	S	S	S	S	S	S	-	S	-	S	S	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	2
508	996518	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
509	986887	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	M	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
510	994631	-	XDR	R	R	R	R	R	R	R	R	R	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1
511	994631	-	MDR	R	R	R	S	R	R	R	R	-	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	1
512	981434	-	XDR	R	S	M	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
513	997791	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-
514	987055	-	-	S	S	S	S	S	S	S	S	S	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	28
515	999435	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	20
516	999567	-	MDR	R	R	R	R	R	R	R	R	R	R	R	R	S	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
517	999577	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	EXP	1
518	997340	-	XDR	R	R	R	R	R	R	R	R	R	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	4
519	1000511	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	2
520	988999	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
521	936851	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
522	963636	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1
523	998058	-	-	S	S	S	S	S	S	S	S	S	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	14
524	925248	YES	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
525	808357	YES	-	S	S	S	R	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
526	1002524	-	-	S	S	S	S	S	S	S	S	S	S	S	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	-	-	DIS	-
527	9968861	-	MDR	S	S	S	R	S	S	S	S	R	S	R	-	-	-	R	-	-	-	S	-	R	-	-	-	-	-	S	-	-	DIS	8
528	1001519	-	XDR	R	R	R	S	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	22
529	1003064	-	-	S	S	S	S	S	S	S	S	S	S	S	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	-	-	DIS	-
530	1002664	-	XDR	R	R	R	R	R	R	R	M	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
531	975690	YES	-	S	S	S	S	S	S	S	S	S	S	S	S	R	-	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	-
532	6624	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	S	S	S	-	-	-	DIS	-

Sr No	MRD No.	PATIENT DETAILS			Sample Date	LOCATION	BLOOD CULTURE GROWTH	CLINICAL DIAGNOSIS						
		NAME	Age	Sex					DIABETES MELLITUS	HYPERTENSION	CHR PULMONARY DS	CARDIOVASCULAR DS	CHRONIC KIDNEY	NEUROLOGICAL DS
533	1004049	MK	54	M	23-Dec	HDHI	Acinetobacter baumannii	MI	-	YES	-	YES	-	-
534	912931	AS	43	M	24-Dec	GASTRO WARD	Ecoli	ALD	-	-	-	-	-	-
535	1004561	BM	2D	F	24-Dec	PAED-ICU	Acinetobacter baumannii	PRETERM, SEPSIS ON VENTI	-	-	-	-	-	-
536	998540	BC	75	M	26-Dec	ENT WARD	Ecoli	AKI	-	-	-	-	-	-
537	1005164	TM	10	M	26-Dec	PAED-ICU	Salmonella paratyphi A	COMPLICATED ENTERIC FEVER	-	-	-	-	-	-
538	1001519	OJ	8M	M	26-Dec	EMG	Klebsiella pneumoniae	SEPSIS	-	-	-	-	-	-
539	996174	JS	41	M	26-Dec	NEUROSURGERY WARD	Klebsiella pneumoniae	MENINGITIS	-	-	-	-	-	YES
540	1005339	PK	38	M	26-Dec	PSYCHIATRY WARD	Pseudomonas aeruginosa	AKI	-	-	-	-	-	-
541	826032	BG	4	M	27-Dec	MEDICINE WARD	Klebsiella pneumoniae	FEVER	-	-	-	-	-	-
542	1006220	RT	84	M	29-Dec	HDU	Ecoli	CLD	-	-	-	-	-	-
543	1001757	NG	55	M	29-Dec	M-ICU	Klebsiella pneumoniae	AKI	-	-	-	-	-	-
544	1002604	HK	51	M	29-Dec	SURGERY WARD	Ecoli	CLD	-	-	-	-	-	-
545	1006475	JS	39	M	29-Dec	NEPHRO WARD	Ecoli	AKI	-	-	-	-	YES	-
546	1004485	SK	53	F	30-Dec	HDU	Klebsiella pneumoniae	ALD	-	-	-	-	-	-

Sr No	MRD No.	MALIGNANCY	CHARACTERIZATION MDR / XDR /PDR	CARBAPENEM RESISTANCE	AST PATTERN BY VITEK-2 ACCORDING TO CLSI																										RESULT (in ug/ml)	INTERPRETATION	OUTCOME	ICU days
					AK	GEN	COT	CFSB	PT	AMC	IMI	ERT	MER	CIP	CAZ	MINO	CTX	CFM	PB	TG	LEVO	CPM	TIC	CTR	AZI	OF	AMP	CXM	C	COL				
533	1004049	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	R	-	-	S	R	R	-	-	-	-	-	-	-	S	<2	I	EXP	-
534	912931	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	-	-	LAMA	-
535	1004561	-	-	S	S	S	S	S	S	S	S	-	S	S	S	S	S	-	-	-	R	S	-	-	-	-	-	-	-	S	-	-	DIS	4
536	998540	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	S	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
537	1005164	-	-	-	-	-	S	-	-	-	-	-	-	R	-	-	-	R	-	-	-	-	-	S	S	S	R	S	S	-	-	-	DIS	2
538	1001519	-	XDR	R	R	R	S	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
539	996174	-	XDR	R	R	R	S	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
540	1005339	-	XDR	R	R	R	R	R	R	R	R	-	R	R	R	R	-	-	-	-	R	R	-	-	-	-	-	-	-	S	<2	I	DIS	-
541	826032	-	XDR	R	R	R	R	R	R	R	S	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	-
542	1006220	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	S	-	-	-	S	-	S	-	-	-	-	-	S	<2	I	DIS	21
543	1001757	-	XDR	R	M	M	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	DIS	3
544	1002604	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	M	-	-	-	S	-	S	-	-	-	-	-	S	<2	I	DIS	-
545	1006475	-	MDR	S	S	R	R	S	S	R	S	S	S	R	-	-	-	R	-	S	-	S	-	R	-	-	-	-	-	S	-	-	DIS	-
546	1004485	-	XDR	R	R	R	R	R	R	R	R	R	R	R	-	-	-	R	-	-	-	R	-	R	-	-	-	-	-	S	<2	I	EXP	1

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Date 20/4/2021

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 22.01.2021 has approved the plan of thesis of **Dr. Samandeep Kaur**, a student of your college for **MD Microbiology** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
To study the colistin susceptibility of gram negative isolates from blood samples

Supervisor
Dr. Jyoti Chaudhary
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Co-Supervisor
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The student has to submit the three copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

SP Singh
Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. ***If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.***
2. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

TO STUDY THE COLISTIN SUSCEPTIBILITY OF GRAM NEGATIVE ISOLATES FROM BLOOD SAMPLES

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED IN

PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MD

In

MICROBIOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

NOVEMBER, 2019

DR SAMANDEEP KAUR

DEPARTMENT OF MICROBIOLOGY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	TO STUDY THE COLISTIN SUSCEPTIBILITY OF GRAM NEGATIVE ISOLATES FROM BLOOD SAMPLES
For the degree of	MD (Microbiology)
Name of the candidate	Dr. Samandeep Kaur
Supervisor	Dr. Jyoti Chaudhary, Associate Professor, Department of Microbiology, DMCH, Ludhiana
Co-supervisor	Dr. Veenu Gupta, Professor, Department of Microbiology, DMCH, Ludhiana
Institution	Dayanand Medical College and Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Antibiotic resistance among Gram negative bacterial pathogens in the hospital and community has been a concern for the health care providers. These infections are leading to increased treatment costs and poor patient outcome due to antibiotic treatment failures. Over the last decade, an increase in carbapenem resistant bacteria has resulted in the widespread use of combination therapy with colistin as the backbone of the regimen. This study aims to identify Gram negative isolates from blood samples and to determine their antibiotic susceptibility pattern to commonly used antimicrobial agents by VITEK-2 system and further testing of colistin MIC (minimum inhibitory concentration) by microbroth dilution technique in carbapenem resistant Gram negative isolates.

Aim of study: 1. To identify and determine the antibiotic susceptibility pattern of Gram negative isolates from blood samples. 2) To determine the colistin MIC of carbapenem resistant Gram negative isolates by micro-broth dilution technique.

Materials and Methods: This prospective study will be carried out in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana, over a period of one year. Gram negative isolates from blood samples will be identified and their antibiotic susceptibility pattern will be determined by VITEK-2. Carbapenem resistant Gram negative isolates will be tested for colistin susceptibility (MIC) by microbroth dilution technique

Clinical significance: To promote rational use of antimicrobials for the sustainable management of infections.

Keywords: Carbapenem resistant, Colistin MIC, Microbroth dilution technique, colistin reistance, Gram negative bacteria

Samandeep Kaur (Signature) Candidate

(Signature) Co-supervisor

Jyoti Chaudhary (Signature) Supervisor

(Signature) Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"TO STUDY THE COLISTIN SUSCEPTIBILITY OF GRAM NEGATIVE ISOLATES FROM BLOOD SAMPLES"** exist in the Department of MICROBIOLOGY, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

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APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Samandeep Kaur
Department	Microbiology
Topic of Thesis	TO STUDY THE COLISTIN SUSCEPTIBILITY OF GRAM NEGATIVE ISOLATES FROM BLOOD SAMPLES
Likely date of appearing in PG examination	May 2022
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Dr. Jaspal Singh (Professor & Head, Surgery)	Mr. A K Jindal (Member, Ethics Committee)
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Dr. Sandeep Kaushal (Assistant Dean Academics)	Dr. Deepinder K Chhina (Professor & Head, Microbiology)
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	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / ~~No~~

Dr. Sandeep Puri
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Research Committee

Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	DR. SAMANDEEP KAUR VILL. GARHI TARKHANA, P.O. TAKHRAN, TEH. SAMRALA, DIST. LUDHIANA, PUNJAB.
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL, LUDHIANA, PUNJAB.
3	COURSE OF STUDY AND SUBJECT	MD MICROBIOLOGY
4	DATE OF ADMISSION OF COURSE	6TH MAY, 2019
5	TITLE OF THE TOPIC	To study the colistin susceptibility of Gram negative isolates from blood samples

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR STUDY

The emerging antibiotic resistance among Gram negative bacterial pathogens in the hospital and community has been a great concern for the health care providers due to the limited treatment options. Gram negative bacteria commonly result in respiratory tract infections, sepsis, intra-abdominal infections, skin, urinary tract infections and soft tissue infections. As compared to other patients, the patients in ICU has 5-7 times higher risk of infection. These infections are an important reason for prolonged hospitalization, leading to increased treatment costs and poor patient outcome in form of increased morbidity and mortality. The treatment of multidrug-resistant Gram-negative bacteria (MDR-GNB) infections in critically ill patients presents many challenges.

These resistant pathogens were earlier considered to be nosocomial pathogens, but it is now evident that they have spread to the community. The emergence of resistance to multiple antimicrobial agents in these pathogenic bacteria has become a significant threat to public health, as there are fewer or sometimes even no, effective antimicrobial agents available for infections caused by these bacteria.[1]

Hospital associated infections caused by multidrug-resistant Gram negative bacteria, especially *Klebsiella pneumonia, Acinetobacter baumannii* and *Pseudomonas aeruginosa* is a growing problem worldwide. Carbapenem-resistance among GNB, members of Enterobacteriaceae such as *Escherichia coli, Klebsiella spp., Enterobacter spp., Proteus spp.,* and among non-lactose fermenters, *Pseudomonas spp.*, and *Acinetobacter baumannii* are being reported with increasing frequencies worldwide. Treatment options for infections caused by these pathogens are limited. Thus, surveillance of antimicrobial resistance in frequently isolated bacterial pathogens is of great importance and it has also renewed interest in colistin as a therapeutic option.

Colistin was first introduced in 1950s and was used until the early 1980s for the treatment of infections caused by Gram-negative bacilli. It was revealed that colistin has side effects of nephrotoxicity and neurotoxicity; therefore, the use of this antibiotic was stopped and it was replaced by other antibiotics which were effective and were considered safer at that time.

Colistin belongs to polymyxin group of antibiotics (Polymyxin E). It targets the bacterial cell membrane. It has been reintroduced in clinical practice for treating carbapenem resistant gram negative bacteria especially *Klebsiella, Pseudomonas*, and *Acinetobacter*. Parenteral Colistin (in the form of colistimethate sodium) has been used to treat ventilator-associated pneumonia (VAP) and bacteremia. Inhaled Colistin is used for treating pneumonia/VAP due to MDR gram-negative organisms and also used prophylactically in patients with cystic fibrosis.

However, colistin resistance is beginning to emerge, raising with it the spectrum of untreatable Gram-negative infection resulting in difficult antibiotic therapy. Colistin resistance among GNB, especially *K. pneumoniae*, is emerging in Indian hospitals. Recent hospitalization, prolonged hospitalization, presence of diabetes and CKD, use of invasive devices, and prior colistin exposure were all commonly seen. Elevated colistin MICs have been noted worldwide, underlining the importance of accurate colistin susceptibility results. Rapid and reliable colistin susceptibility testing is needed in routine clinical laboratories to allow appropriate therapeutic decision-making.

According to CLSI 2019 changes and updates the only approved method of MIC testing for colistin is Broth microdilution method.[2]

This study aims to identify, determine antibiotic susceptibility testing of Gram negative isolates from blood samples by VITEK-2 system and further testing of colistin MIC for carbapenem resisitant Gram negative isolates by broth microdilution technique. This study is also important for

selection of antibiotics for empirical therapy in the hospitals based on local epidemiological resistance profile of the organisms.

6.2 REVIEW OF LITERATURE

Gram negative bacteria are common cause of respiratory tract infections, sepsis, intra- abdominal infections, skin, urinary tract infections and soft tissue infections. These infections are most commonly encountered in patients admitted in ICUs. Infections due to Gram negative bacteria resistant to various antibiotics is rising day by day. These resistant pathogens have become significant threat to public which has led to the use of antibiotics such as colistin as the treatment option. [1]There are a few studies which show the rising trends of antimicrobial resistance.

In a 18 month retrospective study by RajalaxmiArjun et al, twenty-four colistin-resistant isolates were reported. Previous hospitalization within 3 months was noted in all 24 patients. *Klebsiella pneumoniae* constituted 87.5% (21/24) of all isolates.[3]

In an another study done by Manohar et al in Tamil Nadu, a total of 89 gram negative bacterial isolates were screened for meropenem resistance and colistin resistance. MIC for colistin was determined by broth microdilution method. MIC testing showed that 65 %(58/89) were resistant to meropenem and 32 %(29/89) isolates were resistant colistin, whereas 30 %(27/89) isolates were resistant to both antibiotics.[4]

A study conducted in Central India provided information regarding prevalence of bacteria isolated from LCBSI(Laboratory confirmed blood stream infections) In this study *Staphylococcus* spp. including *Staphylococcus aureus* (n = 13) and CONS (n = 7) were most prevalent (33%) followed by *Klebsiella pneumoniae* (20%) and *Escherichia coli* (13%). Such data is important in the selection of empirical antimicrobial treatment of BSI cases. [5]

Veeraraghvan B et al, studied a total of 2731 gram negative bacterial isolates and the most frequently isolated pathogens was *E. coli* 44%, *K. pneumoniae* 25% and *Pseudomonas aeroginosa* 11%.The rate of extended spectrum beta-lactamase(ESBL) positive isolates were ranged from 66%-77% in *E.coli* and 61%-72% in *K. pneumonia*. This study data

shows that carbapenams, amikacin and colistin continue to be the best agents available to treat drug-resistant infections.[6]

A short term study done at Wardha was undertaken to detect the incidence of multidrug resistant(MDR), extensively drug resistant(XDR) and pan drug resistant(PDR) bacterial isolates in a tertiary care hospital. A total of 1060 strains were studied out of which 37.1% strains were MDR, 13.8% strains were XDR, and no PDR was isolated. All gram negative bacteria were 100% sensitive to colistin. Hence, close monitoring of MDR, XDR, PDR must be done by all microbiological laboratories to implement the effective measures to reduce threat of antimicrobial resistance.[7]

In a cancer hospital 1-year study showed that among the Gram-negatives isolates(76), the most prevalent organism isolated was *E.coli* (32.89%) followed by *Acinetobacter* (28.94%) and *Klebsiella* (15.78%). Study showed a very high resistance among the Gram-negative bacteria (GNB) against various antibiotics. Resistance to carbapenems was highest among *Pseudomonas* (25%) and *Klebsiella*(25%) followed by *Acinetobacter* [22%].[8]

Colistin has been a reserve drug used for treatment of carbapenem resistant Gram negative bacterias. Carbapenem resistance in *K. pneumoniae* has been increasing in India and is as high as 44%. Colistin resistance is mainly mediated by mutations causing alteration in the LPS of bacterial outer membrane. Recently there has been emergence of plasmid mediated resistance due to mcr-1 and mcr-2 genes which poses a threat for the rapid global spread. In a study by Agila K Pragasm et al Eight *K. pneumoniae* were isolated from blood culture. All isolates were extremely drug resistant (XDR). The MIC-values determined by broth microdilution method for colistin and polymyxin B ranged from 4 to 1024 and 0.5 to 2048 µg/ml.[9] This study thus stresses upon avoidance of inappropriate usage of colistin.

A retrospective study of all patients with positive cultures of specimens from any source was conducted in Los Angeles over a 6-year period to

develop a comprehensive model for the risk of infection with Colistin resistant GNB, with a specific focus on Colistin resistant *K. pneumoniae*. Out of 28,512 Gram negative isolates from 12,388 patients, and 128 of these isolates were Colistin resistant and out of 4,557 *K. pneumoniae* isolates 68 of these were Colistin resistant. Risk factors included admission from a nursing home and location in an ICU, comorbidity, a prior specimen culture positive for a carbapenem-resistant organism, and prior treatment with colistin. Increasing age was associated with Colistin resistant(Col^r) *K. pneumoniae* but not Col^r GNRs. The most prominent comorbidity associated with Col^r was the neurologic disease category of the Elixhauser score.[10] The Elixhauser category of neurologic disease includes cerebral degeneration, movement disorders, degenerating neuropathies, seizure disorders, and anoxic brain injury.[11]

This situation warrants the implementation of an efficient infection control program and intensive surveillance of Gram negative bacteria so as to establish a rational antibiotic program for sustainable management of infections.[12]

Despite advance in diagnosis and treatment, blood stream infections present as challenging and a life threatening problem. Therefore timely detection, identification and antimicrobial susceptibility testing of blood borne pathogens are one of the most important functions of diagnostic microbiology laboratory.[13]

Early, appropriate treatment of patients infected with colistin-resistant (Col^r) Gram-negative rods (GNRs) and colistin-resistant *Klebsiella pneumoniae* isolates has been associated with reduced mortality.[14-16]

Initial antibiotic selection remains a challenge. A delayed start of microbiologically active antibiotic therapy has been shown to increase mortality and hospital length of stay [17,18], while overuse of broad-spectrum antibiotics has been linked with an increased prevalence of MDROs.[19,20]

In a 3 years study at Athens, Greece, inadequate antimicrobial treatment of infection was an important and independent determinant of mortality in critically ill patients. In that series patients receiving inadequate treatment had an in-hospital mortality rate of 52.1%, as compared with 12.2% in those patients who were adequately treated.[21] Inappropriate use of colistin in the hospitals should be avoided to prevent the further spread of resistance.

This situation stresses upon the implementation of an efficient infection control program and intensive surveillance of antimicrobial resistance of Gram negative bacteria for the management of such infections.[1]

International committees (EUCAST/CLSI) reevaluated inconsistencies surrounding colistin antimicrobial susceptibility testing (AST), concluding that broth microdilution (BMD) should serve as the reference method for AST.[22] Owing to the large size and cationic nature of polymyxins, disk diffusion and gradient diffusion have been demonstrated to be unreliable.[2]

6.3 AIMS OF THE STUDY

- To identify and determine the antibiotic susceptibility pattern of Gram negative isolates from blood samples.
- To determine the colistin MIC of carbapenem resistant Gram negative isolates by micro-broth dilution technique.

7. MATERIALS AND METHODS

This prospective study will be carried out in the Department of Microbiology, Dayanand Medical College and Hospital, Ludhiana, over a period of one year. Gram negative isolates from blood samples will be identified and their antibiotic susceptibility pattern will be determined by VITEK-2. Isolates will be further characterized as MDR/XDR/PDR.

Carbapenem resistant Gram negative isolates will be tested for colistin susceptibility (MIC) by microbroth dilution technique.

7.1 SOURCE OF DATA

All Gram negative bacterial isolates obtained from blood samples of the patients admitted in DMCH, Ludhiana.

7.2 METHOD OF COLLECTION OF DATA

Inclusion criteria:

•All Gram negative bacterial isolates from blood samples of admitted patients.

Exclusion criteria:

•All samples from OPD patients.

•All Gram positive isolates obtained from blood samples.

SAMPLE COLLECTION:

Under all aseptic conditions 5-10ml of blood sample will be withdrawn from antecubital vein with a disposable syringe and will be inoculated directly into commercially prepared BACTEC 9240 or BacT/ Alert culture bottles.

Processing of samples: Samples received in microbiology lab will be processed as per standard protocols.

Culture:

Pre-inoculated blood culture bottles will be loaded in the Bactec or Bac T Alert microbial detection system and incubated for a maximum period of 7 days or till the bottle is indicated positive by the system and the time to positivity will be noted.

Processing of blood culture positive bottles:

Smears will be prepared from positive blood culture bottles and Gram staining of smears will be done. Positive bottles will be sub-cultured on MacConkey's and Blood agar plates. The plates will be incubated at 37°C for 18-24hrs.

Identification

Organisms will be identified by Gram staining, colony characteristics, biochemical reactions and VITEK-2 system.

Antimicrobial susceptibility testing:-

Antimicrobial susceptibility testing will be done using VITEK-2 system in which Gram negative bacteria will be tested for the antibiotics as per CLSI guidelines.

Broth microdilution method will be used to determine the MIC of colistin for carbapenem resistant Gram negative isolates.

MICROBROTH DILUTION METHOD:

Microbroth dilution method will be performed according to CLSI guidelines.[2] All organisms intrinsically resistant to colistin such as *Stenotrophomonas, Burkholderia, Proteus, Serratia, Morganella* and *Providencia* will be excluded.

The reference powder (colistinsulphate salt) of 30,000units/mg and organism suspension of $5x10^5$ CFU/ml will be used.

The total volume in each well of 96 well microtitre plates will be 100ul. In each well 50ul of MHB(Muller Hinton broth), 25ul of drug(colistinsulphate stock solution) and 25ul of organism suspension will be added. The plate will be incubated overnight at 37°C. Results will be noted next day. Gram negative isolates with colistin MIC of >2ug/ml will be labeled as colistin resistant.[23]

Outcome: Records of patients with infection of colistin resistant Gram negative bacteria will then be analyzed such as age, sex, co-morbidities, ICU stay, presence of indwelling devices, prior antibiotic exposure within 3

months, colonization versus true infection, antibiotics used and treatment outcome.

Statistical analysis:

Data will be described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations will be done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Not Applicable

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached Herewith

8. LIST OF REFERENCES

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PROFORMA

Sr. No.

Name

Lab No.

Age/ Sex

Date of admission

MRD no.

Admission No.

Date of sample collection:

Provisional diagnosis:

Chief complaints:

Risk factors:

Treatment history:

Investigations:

Candidate signature

Supervisor signature

Microbiological evaluation:

- Culture
- Antimicrobial susceptibility testing
- MDR/XDR/PDR
- Colistin susceptibility (MIC)

Outcome:

Candidate signature **Supervisor signature**